Popular Science

MONTHLY *Founded 1872*

MAY 1 1930

June
1930
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See page 24

Patent Office a National Disgrace

20 Home Workshop FEATURES

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Gliding
by W. H. BOWLUS

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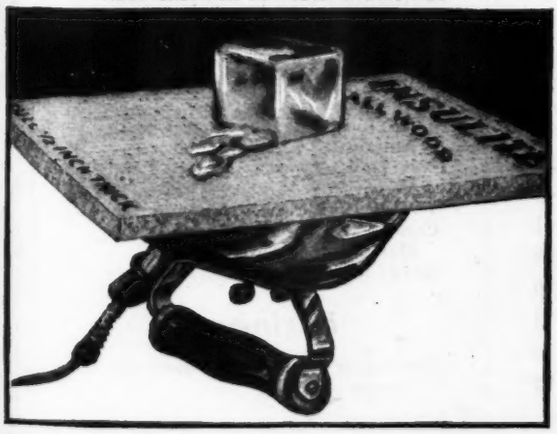

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POPULAR SCIENCE MONTHLY
381 Fourth Ave., N. Y. C.

Electric Lights and the Long Haul Insure Profits to Any Investor

By CHALLISS GORE, *Financial Editor*

ROBERT HOLLAND certainly felt as if he had rushed "in where Angels fear to tread" the day he mentioned buying public utilities to Anthony Garrett.

"Don't get me wrong, Bob," Garrett interposed, "I haven't got a thing against you in particular. But anyone who talks public utility investments to me is almost in for a scrap!"

"Why the fighting words, Anthony?"

"Oh, merely a trivial matter of $3,500, —big money to me," replied Garrett. "On September 1st last year my firm declared its first division of profits since I became a partner. I drew an even $10,000 in cash—which has now dwindled to $6,500 through the depreciated value of public utilities I bought."

"Nonsense, Anthony, pure nonsense. Anyone of us who thinks he can buy a stock at the bottom and unload it at the top is either crazy, or Mr. Wall Street himself. Don't forget that you invested at a time when public speculation was so disproportionately great that practically all stocks on the board, including public utilities, were selling at prices that may not be justified by earnings for some time to come. What's that you have there on the newspaper?"

"This?—a chart showing stock market average prices on public utilities. On the side here, I've applied it to my own investment."

Holland took the paper and glanced at Anthony's own calculations.

My investment.....	$10,000
Lowest Utility Price 1929..	3,703
March 1930 price.....	6,481

Then he lit a cigarette, leaned back in his chair and for a few minutes watched the river traffic far below the window at his right. In his mind he was preparing an effective means of correcting the unfair, yet common prejudice that his friend had developed. It was totally unsound, he knew, because Garrett had built up a general attitude on the foundation of one particular, untimely venture. Holland realized that the best way to emphasize the error was to carry Anthony's own false method of reasoning a little further. That way, it would be simple to prove that his friend was wrong. Having done that, he would go ahead and show him that in choosing public utilities, unknowingly or not, Garrett had selected one of the finest groups of common stock values he could possibly have bought.

"All right," Holland began, "I'll admit that Public Utility Common Stocks dropped mighty low in last year's crash—for the perfectly good reason that in the last months of speculative frenzy, the heaviest public play was in utilities. But let's suppose your firm had distributed its profits earlier, and that you had made your investment in January 1929 instead of in September. Then the figures would look like this," he ended, taking up a pencil and tabulating the following:

January,	1929.....	$10,000
September,	1929.....	19,518
November,	1929.....	7,229
March,	1930.....	12,650

"There you have the same stocks," continued Holland, "the same method of figuring—with only a change in the date of investment."

"Well, what of it?" grumbled Garrett.

"Now, just a minute, Anthony. Here's another supposition: if you had invested the same money in November, after the crash, the figures would read like this:

November,	1929.....	$10,000
March,	1930.....	17,500

"Now, do you get my point?"

"Yes and no," replied Anthony. "After all, Bob, I didn't invest in January—nor in November, for that matter. But I did invest in September—much to my sorrow."

"Exactly. Doesn't that prove that you can't blame it on the public utilities, any more than you could blame it on any other group? Doesn't that conclusively show that it was purely a matter of money invested at the wrong time, rather than in the wrong things?"

"I guess you're right," yielded Garrett, "but right or wrong, I'm still out $3,500 on public utilities."

"Very well," Holland replied. "Now you just sit back for a few minutes. I'm taking the floor. And I'm going to show you, if I can, just what's behind that $10,000 investment of yours. When I'm through, if I haven't proved to you that the wisest thing you can do now is to hold on to your securities, because you've invested in a financially sound industry, constantly advancing through efficient management and scientific research—then I've been wasting my breath and your time. Is it worth the chance?"

"Go ahead, Bob—I'll listen."

"For one thing, Anthony, last year while the public was indulging in the greatest speculative orgy the market has ever known, electric light and power utility companies gained over a *million* customers, bringing their total in this classification up to 24,257,159 users. These customers paid $2,107,000,000 for electric service—more, by the way, than the total subscription of the first Liberty Loan issue. I've a page here on my desk, cut from

(*Continued on page 6*)

Electric Lights and the Long Haul Insure Profits to Any Investor

(*Continued from page 4*)

'The Electrical World,' conveying an idea of the amazing growth of the electric light and power industry. Look at these figures:

	1907
Capital	$1,367,239,000
Revenue	$169,615,000
Customers	1,946,979
Population Served	7,500,000
% of total Pop. Served	8%
	1917
Capital	$3,245,185,000
Revenue	$502,060,000
Customers	7,178,703
Population Served	25,250,000
% of total Pop. Served	24.3%
	1929
Capital	$11,100,000,000
Revenue	$2,107,000,000
Customers	24,257,159
Population Served	85,000,000
% of total Pop. Served	70%

"That was last year," put in Anthony, "how about this year, and the ones to come?"

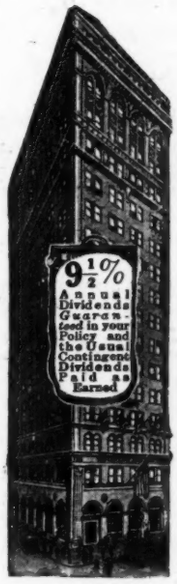
"I hoped you would bring that up," replied Holland. "The utility companies estimate that another million new customers will be gained in 1930. New construction and equipment to take care of this expansion alone will involve an expenditure of $913,574,905. Incidentally, that's the most ambitious program ever undertaken by the industry, exceeding 1929's high total by nearly $50,000,000. In other words, in a year of acknowledged business uncertainty, the utility companies anticipate new records in all departments."

"That sounds encouraging," Anthony interrupted, "but where's it all leading to? Your own figures show that they're swiftly approaching the limit—in the amount of people that can be served."

"On the surface, it would seem so," replied Holland, "but a broader analysis disproves that. There certainly would seem to be an approaching saturation point when you figure that 70% of the population now enjoys electric service, and that an additional 9% or 10% work or live within reach of existing or proposed transmission lines. But it so happens that utility companies are selling more and more service to each customer. In 1912, when 15.9% of the population was being served, the total revenue was $287,000,000; and in 1929, 70% of the total was served, and the revenue was $2,107,000,000. So that while 4⅔ times as many people were served at the end of that period, the total revenue multiplied 7⅓ times. And this comparison becomes even more pointed when you remember that unit costs to the consumer along all lines have been generally and consistently reduced.

"Proving beyond argument, Anthony, that while there may be a theoretical saturation point as far as per cent of population is concerned, there is no visible limit to the amount of electricity that can be used per person. And that brings up another point in favor of the background of (*Continued on page 6*)

How to Buy Life Insurance, and Where



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Electric Lights and the Long Haul Insure Profits to Any Investor

(Continued from page 5)

your investment. You have, by putting $10,000 in public utilities, invested money in science and research, in engineering experiments that are making possible by electrical advancement the greatest changes and improvements in our mode of living and working.

"Take our own lives, our homes for example. Base plugs for lamps and radios, wall plugs for toasters, percolators, waffle irons, electric washers and irons, etc. And now the consumption of electricity is being given a new, tremendous impetus by the electric refrigerator. There are 2,000,000 of them now in use, and at least half a million additional being installed each year. Why, Anthony, there isn't another class of industry in the world that can show the advancement and the possibilities of public utility."

So Robert Holland had succeeded in pointing out the wisdom of buying securities when they sell at prices more closely representing their true values. Also the fact that money invested in electrical power industries or any progressive utility has, in part, been turned over to science and research for the advancement and broadening of consumer services. Over the long haul such investments weather out periods of depression and inflation, bringing back in the end many more dollars than could otherwise have been gained or lost through intermittent speculation.

To Help You Get Ahead

THE Booklets listed below will help every family in laying out a financial plan. They will be sent on request.

Your Income and Your Life Insurance is the name of a brief booklet scientifically answering the question "How much life insurance does a man really need?" Provident Mutual Life Insurance Company of Philadelphia, Pennsylvania, will mail a complimentary copy upon request.

The House Behind the Bonds reminds the investor of the importance, not only of studying the investment, but of checking up the banker who offers it. Address: Fidelity Bond & Mortgage Co., 1188 New York Life Building, Chicago, Ill.

How to Get the Things You Want tells how you can *use* insurance as an active part of your program for getting ahead financially. Phoenix Mutual Life Insurance Company, 328 Elm Street, Hartford, Conn., will send you this booklet on request.

Enjoy Money shows how the regular investment of comparatively small sums under the Investors Syndicate plan, with annual compounding of 5½% interest, builds a permanent income producing estate, a financial reserve for a business, or a fund for university education or foreign travel. Write for this booklet to Investors Syndicate, Investors Syndicate Building, Minneapolis, Minnesota.

How to Retire in Fifteen Years is the story of a safe, sure and definite method of establishing an estate and building an independent income which will support you the rest of your life on the basis of your present living budget. Write for the booklet to Cochran & McCluer Company, 46 North Dearborn St., Chicago, Ill.

Does Money Burn a Hole in your Pocket!

The surest way to save money is to spend it—spend it on a bond. Fidelity Bonds are good bonds to buy. Each is secured by a first mortgage on some new income-producing property. You get 6% on your investment. You take no risk as payment of both interest and principal is guaranteed when due. For your Future's sake, investigate Fidelity Bonds. Mail the coupon for your copy of the book, "The Fidelity Investor."

FIDELITY BOND & MORTGAGE CO.
J. U. MENTEER, President — INCORPORATED 1910

660 Chemical Bldg., St. Louis
1188 New York Life Bldg., Chicago
378 Colorado Nat'l Bank Bldg., Denver

MAIL COUPON TO NEAREST BRANCH
Fidelity Bond and Mortgage Co.
Let us send you, without obligation, our monthly bulletin, "The Fidelity Investor." Simply fill in the coupon below and mail.

*Name*_____
*Address*_____
*City*_____ *State*_____

N2

45,000 FATHERS--

ARE easily providing for the advantages of university education for their children by setting aside 50 cents to $1.00 per day under the time tested Investors Syndicate Plan.

Your name and address below brings informative folder, "The Money Will Be Ready."

170,000 INVESTORS

Name .....

Address .....

INVESTORS SYNDICATE

FOUNDED • 1894
MINNEAPOLIS
NEW YORK LOS ANGELES
OFFICES IN 51 PRINCIPAL CITIES

PSM

SQUARE blade-ends

Easier and safer to handle

MOST MEN like fishing—but not fishing down the drain-pipe for a slippery razor blade. That's one of many reasons why a vast army of men are praising the New Gillette Blade. Its square ends can't slip out of soapy fingers; and how easily the new blade reaches into the tight little corners around the mouth, nose and ears!

There are so many other big improvements that you won't appreciate them all until you try this New Gillette Shave yourself. Here are just a few: no more wiping or drying of parts. New blade resists rust. "Razor pull" is banished forever by new reinforced corners of razor cap and cut-out corners of blade.

Sounds almost impossible to give you all this remarkable new shaving comfort for only one dollar, doesn't it? Yet your dealer has your New Gillette Razor set waiting for you—your choice, in fact, of five styles of handsome cases. Additional new blades are priced at one dollar for ten and fifty cents for five.

Enjoy this new shaving thrill tomorrow morning by seeing your dealer on your way home tonight.

TRADE Gillette MARK

GILLETTE SAFETY RAZOR CO., BOSTON, U.S.A.

$1.00 *for ten; 50c for five.*
The New Gillette Blades in the new green packet

The New Gillette Shave

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Tools, Radio Apparatus, Oil Burners and Refrigerators advertised in POPULAR SCIENCE MONTHLY have been tested or investigated by the Popular Science Institute of Standards and each advertisement carries the insignia indicating approval.

However, other products advertised in the magazine not subject to test carry the same guarantee to readers as products tested.

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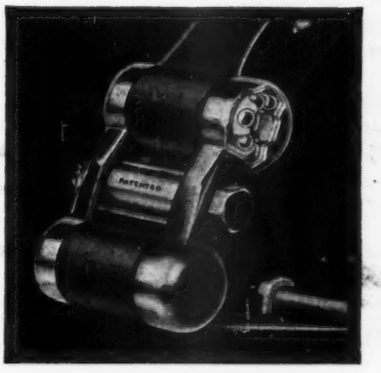
When *SPRING-SLAP* throws a party . . .

AUNT HESTER lets out a quick and exclamatory "Gracious!"—Jane voices a subdued but emphatic "Ouch!"—Bill winces as though someone had shot him. And you . . . well, outwardly you're apologetic, but inwardly you're as mad as a roughed-up hornet. And, we'll add, for a very good reason.

We'll grant that rough roads and unexpected hummocks can weave a frown on the face of the most placid driver. We'll admit that those sudden jolts and jars are as racking on your car as they are on you. But do you know the cause of this commotion?

It's *Spring-Slap*—there's the culprit. It's that slap of your springs as they refuse to flex under impact. It's that bucking and rebellious flare-up of cramped and tyrannized springs—springs that are shackle-bound.

Ordinary spring shackles don't let your springs flex as freely as they should. Often your shackle bolts will be too tight or they bind—and your springs can't do their level best. Nor can your shock-absorbers do their most soothing work, for the wear on ordinary shackle bolts gives them a different job to do every day in the year—and you can't adjust them that often! Naturally, your springs complain—and so do you! But the remedy is simple, easy to apply and inexpensive—a set of Fafnir Ball Bearing Spring Shackles.



On these frictionless, free-acting ball bearings your springs take every bump with rocking-chair easiness, without that objectionable slap-back. Savage jolts are tamed to gentleness. Sudden bumps are shunted aside. You ride the roughest roads with incredible ease, with a new and delightful sense of comfort.

Fafnir Ball Bearing Spring Shackles completely banish shackle squeaks and rattles—yet you never have to grease them. You never have to adjust them. They prolong the life of your car. They enable your shock-absorbers to do their full duty. And they are *safer*—no shackle bolts to wear and let you down.

They are standard equipment on many cars. They can be put on yours for a cost so little that it will surprise you. Ask your garage mechanic about them.

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FAFNIR

FAFNIR — MOST COMPLETE LINE OF PRECISION BALL BEARINGS IN U.S.A.

BALL-BEARING SPRING SHACKLES

THE FAFNIR BEARING COMPANY

NEW BRITAIN, CONN.

The Fafnir Bearing Company
New Britain, Conn.

Please send me information about Fafnir Ball Bearing Spring Shackles.

Name_____

Street_____

City_____ State_____

P.S.M.-6

Why We Can't Tell You What's Coming In Our July Issue

WHEN darkness fell over the city of Paris on the evening of May 21, 1927, the editors of the great newspapers of France could not have told you what would be said about Lindbergh in their papers the next morning. They still didn't know that he would arrive and thereby push all other news from the front pages. But reporters from the great news-gathering organizations stood watch with the excited throng at Le Bourget to rush the story of this most electrifying event—white hot from the landing field—if it happened.

POPULAR SCIENCE MONTHLY can not tell at this date, all that will be in the July issue. Perhaps the most exciting thing it will tell about has not happened even yet! For it is its fresh, vivid, white hot news quality that distinguishes this journal from all others of its kind. It is never cut and dried months or even weeks before going to press.

POPULAR SCIENCE MONTHLY has watchful editorial representatives all over the world. These alert, "eye witness" reporters quickly flash to headquarters in New York, first-hand news of every important discovery, experiment, process or device that the readers of POPULAR SCIENCE MONTHLY should know about. In many cases these representatives are the scientists, actually conducting new experiments themselves, in other instances our reporters keep in touch with the great laboratories where things are evolving, they are in contact with manufacturing plants where new and better methods are being tried. Their business is to be first with the news about important improvements in machinery, in agriculture, in medical science, in bridge building, in everything that we want to tell our readers about before all the rest of the world knows.

And often, at the last minute before going to press, comes a startling story from across the country—a story of such immediate importance and exciting interest that the issue must be recast to make way for it.

But we do know now that a number of stories in the July POPULAR SCIENCE will be of such absorbing interest that you simply must not miss them. Who do you suppose, for instance, is the most picturesque character in American Aviation? We know the first name you will think of—and it is not the right one. No life in any line of endeavor has been more packed with drama and human interest than that of this great flying man you will read about in our July issue.

And do you know why certain secretions in the human body poison character and incite men to violence and murder. There is an immediate relation between the chemistry of the human body and crime. And in the July issue a great surgeon tells about successful gland operations already performed by the most able surgeons in the world which prove that surgery can correct the cause in the case of many hardened criminals.

Wouldn't you be amazed to see tender, juicy asparagus on your table, *five times as big* as that you now get! A scientist in agriculture announces in the July issue that after long, tedious study and experiment he has succeeded in feeding growing vegetables in a manner which may ultimately revolutionize farming.

And then, following the article about the Patent Office in this issue, there will be another in July to tell why and how the Patent LAWS must be revised, to protect inventors and industries, to stop infringement suits brought only to harass and ruin others.

These are just a few "spots of interest" from our July issue which is one of the very best we have ever printed. Get it at your news-stand as soon as it is issued—or if you wish to be certain not to miss any of the intensely interesting numbers for the next 14 months to come, you may clip and mail the coupon below—and secure without one penny of extra cost, a copy of the famous "Pocket Guide to Science."

"The Pocket Guide to Science"—FREE—With Your Name in Gold

This wonderful book answers every question that the average man wants to know about Science. In simple words every department of Science is covered in fascinating questions and answers that give a wonderfully clear, comprehensive understanding of this absorbing subject.

THE POCKET GUIDE TO SCIENCE is bound in beautiful flexible fabrikoid. We will stamp your name in 22-carat gold on the cover of THE POCKET GUIDE at no extra cost to you if you mail the coupon immediately.

We extend to you the Special Offer of a 14 months' subscription to POPULAR SCIENCE MONTHLY (regular price by the month would be $3.50) with the THE POCKET GUIDE TO SCIENCE—all for $2.95, plus the postage. If you are already a subscriber to POPULAR SCIENCE we will extend your subscription 14 months if you accept this offer.

POPULAR SCIENCE MONTHLY 6-30
381 Fourth Avenue, New York

I accept your offer of THE POCKET GUIDE TO SCIENCE and a 14 months' subscription to POPULAR SCIENCE MONTHLY. I will pay the postman $2.95, plus the postage when he delivers the POCKET GUIDE and the first issue of POPULAR SCIENCE MONTHLY. If the book and magazine are not fully satisfactory to me I will return them within 10 days and you are to promptly refund my full payment. Please stamp my name in gold.

Name.....

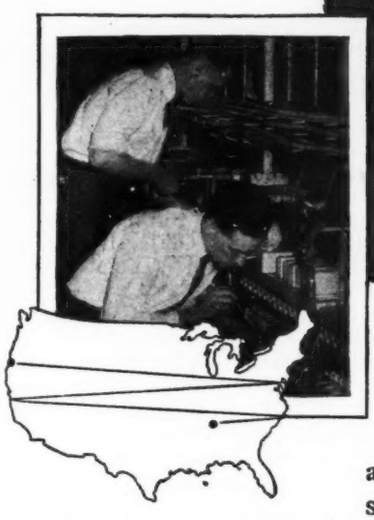
Address.....

City.....*State*.....

If you prefer send $2.95 with your order

Backing up your *Telephone*—

The Man in the Iron Mask—electro-welding a switchboard frame—is one of many skilled workers who see that every part is made right.



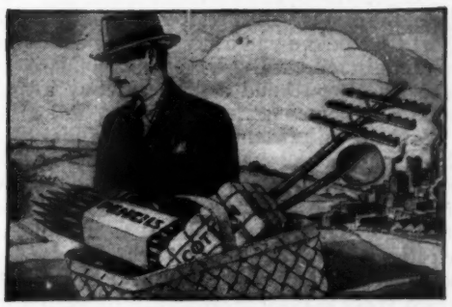
Wire Enough in a Single Telephone Exchange to span the United States three and a quarter times!

To make your telephone

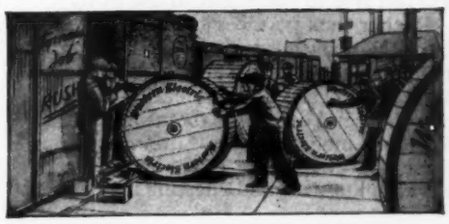
and back it up with all the apparatus and supplies needed for your service is a work of infinite variety.

Buying rubber from Singapore, mica from India, conduit from Ohio—Making each year a million telephones, 15,000 miles of cable, switchboards by the trainload—Distributing supplies to 32 warehouses, holding them ready for the nation's telephone companies—Installing the equipment in all the telephone exchanges—

All this is the responsibility of Western Electric—whose dependable service of supply helps make possible dependable telephone service.



From Pencils to Telephone Poles everything the Bell Telephone System uses is found in Western Electric's market basket.



Meeting Emergencies is the real test of a service. Western Electric's system of supply distribution is always ready!

Western Electric

MAKERS OF YOUR TELEPHONE

Wise Men Know but Others Guess

By COLLINS P. BLISS
Director, Popular Science Institute
Dean, College of Engineering,
N. Y. University

These booklets have been prepared by engineering experts for the aid of readers of POPULAR SCIENCE MONTHLY.

IF YOU try out a new kind of shaving cream and it fails to come up to your expectations, there is no great damage done; the cost is small and it will be only a short time before you can buy again with greater discretion. But if you make a mistake when you build a house or buy a radio, it becomes rather serious.

To help out in these "once-in-a-lifetime" purchases is the one aim and purpose of *Popular Science Institute*. The Institute was established to aid the readers of POPULAR SCIENCE MONTHLY in the selection of the kind of equipment that is bought only at rare intervals and about which there is little opportunity to learn by experience. Already, forty-one thousand readers have taken advantage of this service and it is hoped that many more will feel free to make special use of it.

Rather than permit guesswork to enter into their business, industrial corporations in the United States are spending $200,000,000 a year for scientific research in a thousand different laboratories. This is a lot of money to invest in research but these concerns figure that the difference between knowing and guessing is worth it.

Good Advice for the Consumer

The consumer buyer is up against a problem, however, in getting the necessary information on which to base his selection. He cannot, like the big business concern, call in experts to make a thorough survey of the field. He may ask the advice of his friends and of salesmen selling that type of equipment, but that is not a sure way of getting worthwhile knowledge. His friends' experience with products that have to be bought but once or twice in a lifetime is likely to be not much more extensive than his own, and the advice of salesmen is rarely unprejudiced. What he can do, however, is to enlist the services of some of the reliable testing organizations that are now functioning for the benefit of consumers.

When investing in radio apparatus, oil heating equipment or tools, buyers will find the *Popular Science Institute* ready with a comprehensive and impartial service—a service based on data that no individual could collect. In the case of radio equipment and tools, the information regarding the merits of various makes is secured by means of laboratory tests that have been made to determine definitely every feature about the product. Through arrangements with New York University these tests are made in the Sage Research Laboratory, with its $350,000 worth of testing equipment.

In the case of oil burners, laboratory tests would not provide worthwhile information since oil burners must be judged under a variety of operating conditions, installed in all kinds of homes and heating systems. Therefore, *Popular Science Institute* has made a field investigation among several thousand users of oil burners in all parts of the country and the findings in this survey supply the Institute with a sound basis for recommending certain makes.

What Institute Approval Means

In determining what equipment merits its approval, *Popular Science Institute* requires that a product be well designed and constructed, efficient and good value at the price sold. If a device falls down in any one of these three respects, it is not put on the Institute's list of recommended makes. Since the datum on which approval is based is complete and accurate, and the decision impartial, buyers who select equipment approved by *Popular Science Institute* can be certain of getting satisfaction.

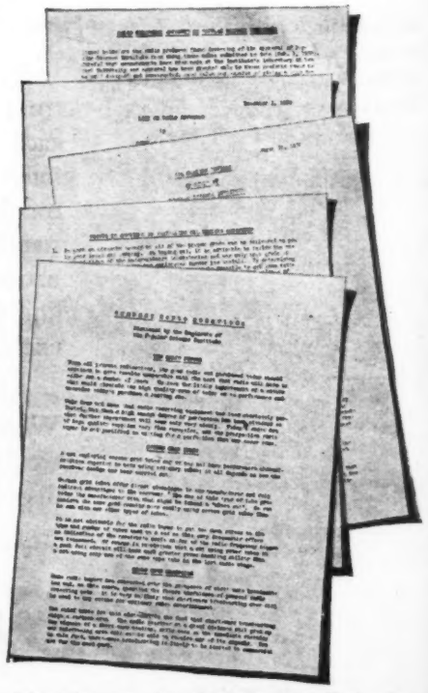
In addition to supplying the names of products that have been approved after investigation, *Popular Science Institute* has prepared several bulletins and booklets that give specific help to the man who is building or equipping his home and wants all the latest facts relating to the subject. *Popular Science Institute* is a clearing house for information regarding equipment of a scientific or semiscientific nature and which makes for modern home comfort, all possible data having been gathered from Government bureaus, University laboratories, etc. These booklets, prepared by engineering experts, have been found to be a most helpful and complete source of information for those who are not informed as to all the latest developments.

Bulletins Available

Readers of POPULAR SCIENCE MONTHLY have the privilege of applying to the Institute for personal information regarding special problems and, in addition, have these bulletins and booklets available:

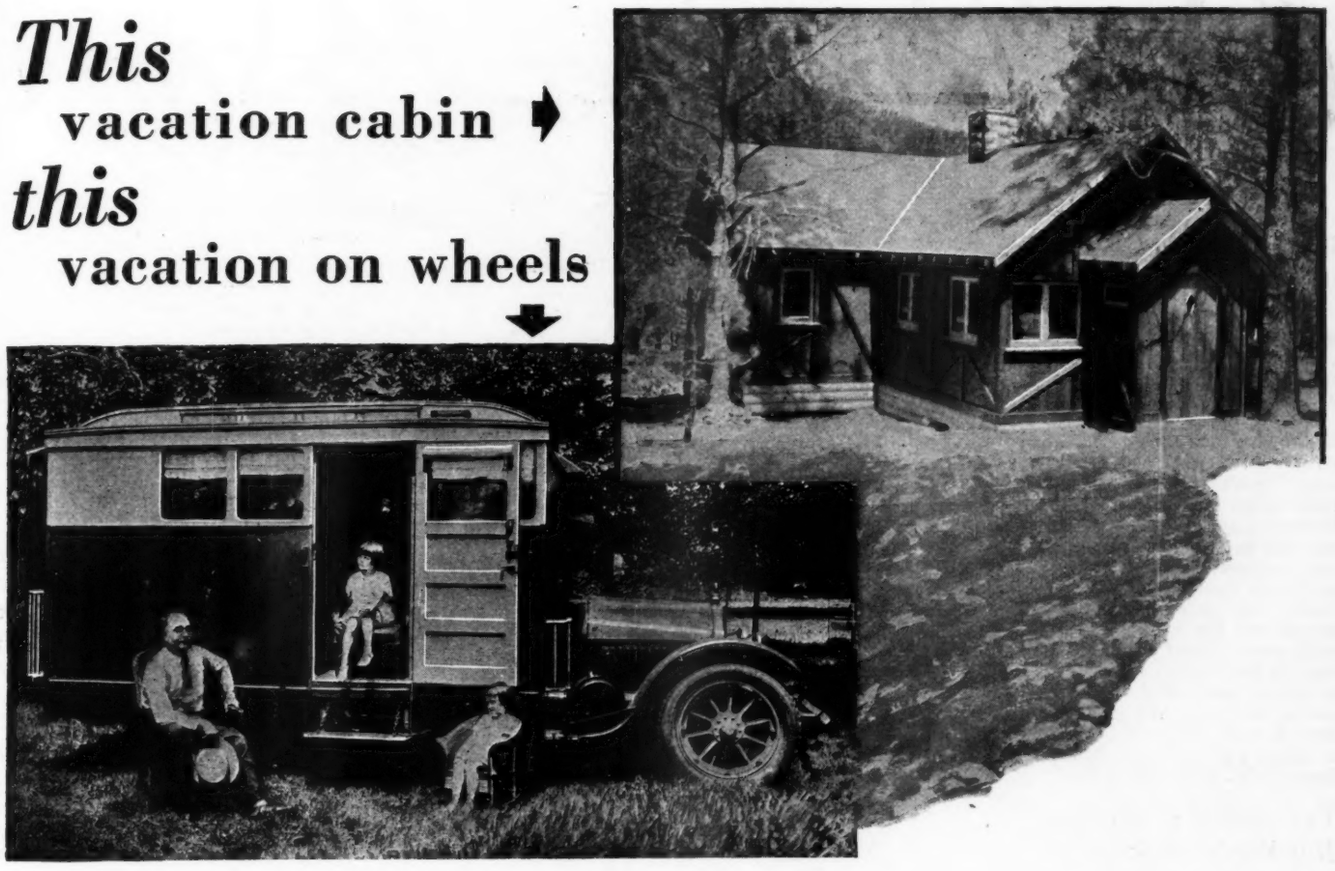
List of Approved Radio Receivers.
Current Radio Questions Discussed.
List of Approved Tools.
List of Approved Oil Burners.
Advice in Installing Oil Heat.
House Heating and Ventilating (25 cents).
Insulation in Building Construction (25 cents).
Refrigeration for the Home (25 cents).

There is a charge only on the last three booklets named, all other service being free. Address all communications to Popular Science Institute, 381 Fourth Ave., New York, N. Y.



Lists of approved equipment, and bulletins relating to their use, can be had from the Institute.

This vacation cabin ➧ *this* vacation on wheels



—*both* are made of Presdwood

What a thrill you get building a cabin in the woods, or a bungalow on wheels; and how easy the job becomes when you use the broad grainless wood boards of Masonite Presdwood. Proof of this is supplied by H. E. Varney, among thousands of others, in his attractive vacation cabin (reproduced above) in the Wrightwood Mountains of California; further proof is supplied by R. D. Anderson of Youngstown, Ohio, who used Presdwood to build the touring bungalow, also shown here.

Builds boats and signs

Presdwood is highly resistive to moisture and warping. It builds rowboats, bath houses, speedboat decks, roadside signs, boat houses and safety water wheels for use at lake resorts. Like natural wood, Presdwood is usually painted when exposed to the weather, or can be varnished to bring out the natural warm color tones and beautiful burled appearance of this grainless wood.

For interior application Presdwood is often used without special finish of any kind. It provides beautiful paneling for modern homes and apartments; makes cottage partitions, bedroom screens, tool chests, dish cabinets, clothes closets, shelving and boxes for supplies.

Presdwood lines concrete forms for office buildings, factory warehouses, schools, dams, bridges and swimming pools. Because Presdwood leaves no grain or knot marks, the broad concrete surfaces require no hand smoothing. Labor costs are drastically cut and the resulting concrete becomes both smoother and stronger.

Manufacturers find that Presdwood adds strength and beauty to their products at the same time that it lowers the cost. This grainless wood does not crack or splinter, can be nailed near the edge without splitting, and is easily handled on band saw or punch press. It reduces waste to a minimum and is liked by the workmen as well as the management.

Send for sample and booklet

Production executives or vacation "fans," experienced builders or home mechanics, will find valuable information in the Presdwood Booklet. The booklet and a sample of Presdwood are sent to you FREE on receipt of the coupon. Just clip and mail it NOW.

MASONITE CORPORATION
111 West Washington Street, Chicago, Illinois

MASONITE CORPORATION © M. C., 1930
Dept. D-6, 111 W. Washington Street, Chicago
Please send me, Free, a sample of Masonite Presdwood and the Presdwood booklet.

Name .....

Address .....

City ..... *State* .....

Masonite
PRESDWOOD
Made by the makers of
MASONITE STRUCTURAL INSULATION

Our Readers Say

Who Will Find the Hidden Scientist?

IT MAY seem presumptuous for an obscure layman like myself to comment on your $10,000 award after the distinguished scientists have had their say in your April number. Still, I'd like to get a little off my chest, so here goes.

Needless to say, your idea to give such a prize is wonderful. But has some provision been made to go out in the highways and byways and find out what poor and unknown investigators are doing to advance the cause of science and the welfare of the race? I grant you, that the fact that a man is without funds or obscure is no guarantee of genius, but it would be a pity if the $10,000 went to some million-dollar corporation while a struggling individual inventor was overlooked.—W. E. T., Joliet, Ill.

You Sound Right— But You're Wrong

I AM so much interested in your magazine that I can hardly wait until I get my copy. I wish there were more articles on aviation.

There is one point on which I do not agree with Randy Enslow in his article, "How I Fly My Plane." I cannot understand why an airplane motor should stop when it races without a load at the breakage of a propeller. It is possible to race the motor of an automobile in neutral gear and I think this is possible with all petrol motors.

Anyway the motor should not stop. Limitation of the air intake may act like a governor but I cannot make out why the motor comes to a standstill.—R. A. P. M., Rews Central, India.

Mr. Enslow explains that the breaking of the propeller removes the load from the engine suddenly, which allows it to accelerate so rapidly that the gas is sucked from the carburetor before it can adjust itself and the motor stops for want of fuel.—The Editor.

Some Folks Are Hard to Convince

I SEE that J. L. A. R. has taken seventeen other magazines and has come to the conclusion that yours is the best. I don't think it should take that many magazines to convince anyone, do you? I wish we could have more "Our Readers Say."—F. E., Parsons, Kans.

Get Those Tools and Make 'Em Rattle

I WAS quite surprised and greatly pleased when I received a check from you for my improvised valve lifter. I was not certain whether my idea would be of any value to you or not. I want to thank you for your reward. Ever since I took manual training I have been trying to collect a set of tools for a home workshop and the check you sent will be a big help.—G. F. B., Stillman Valley, Ill.

Would You Like a Dutch Windmill Model?

THE article "Model Stagecoaching" was greatly enjoyed and I know I am going to have lots of pleasure making a model stagecoach. In answer to your request for suggestions, may I suggest a Dutch windmill? I have always wished to make such a model but have never been able to find the proper working drawings. —A. V. S., Mankato, Minn.

Will Anybody Give Her a Name?

I AM writing at the request of the Science Club of Roosevelt High School, Minneapolis, Minn. This club was recently organized and as yet it has no name. That is the reason they asked me to write to your magazine and ask you for suggestions for a name. Each meeting we have "scientific news" which is taken from your magazine. There are over fifty members, but none of us can think of a suitable name so we are asking your help.—Miss B. S., Minneapolis, Minn.

What! Are You Afraid of the Truth?

WHAT are you trying to do, kill interest in aviation? If you are, just keep on printing pieces like those by Jordanoff. I'll bet that all the people who read them had less desire to go up in an airplane after they finished than they did before they began. Thrilling experiences and escapes from death make interesting reading, I admit, but they don't make people want to leave the ground or trust their lives to airplanes. If your readers were to send in letters on their reaction to such stories, they would all agree with me.—A. L., New York City, N. Y.

Giving the Magazine The Glad Hand

I HAVE long been a reader of POPULAR SCIENCE and consider it the best scientific magazine on the market. It gets better each month.—D. W., Gainesville, Ga.

Just an Old-Fashioned Skeptic

IN PRACTICALLY every issue of your magazine you show new scientific gadgets to aid the police in tracing or capturing criminals. The Chicago police, for instance, have all kinds of ingenious devices to aid them. Yet in this city, as elsewhere, crime is increasing and criminals are getting away with their law-breaking as never before. I don't believe that science has ever helped or ever will help in eliminating crime or making men better.—A. S., Chicago, Ill.

Does This Settle the Kite Business?

ABOUT this kite business and T. A. D.'s request for information as to how near he came to winning the world's record. I refer him to January, 1930, "Parkergrams," which puts the world record at seventy hours, fifty-three minutes, won by T. Diem and J. Gorman of Pennsylvania.—R. A. P., Meriden, Conn.

Who Will Answer This Gravity Question?

I SHOULD like to know the answer to a question which I am not sure about. Some time ago I read an article by a scientist who said that after a body had fallen for a certain length of time it no longer gained speed, but fell at the same rate of speed no matter how much farther it fell. Is this true or does the body gain speed at the rate of 32.2 feet per second continually?—R. W. H., Pittsburgh, Pa.

How Did He Know The Elephant's Age?

IN YOUR April number, I was surprised to see, on page 66, the statement that no elephant is known to have lived beyond the age of seventy years.

During the winter of 1922–23, at one of the smokers of the "Explorers Club," of which I am a member, Martin Johnson gave an exhibition of some of his pictures of wild life in Africa. One of the questions asked Mr. Johnson was, "How long does an elephant live?" He replied that he could not answer that question and referred it to another member of the club who said that he knew elephants were in full health at seventy-five. It seems to me that your statement that elephants do not live more than seventy years is open to question.—R. R. T., Philadelphia, Pa.

One Look at Webster's Makes Us All Happy

I WAS highly interested in your article "Do You Know Your English?" in the POPULAR SCIENCE MONTHLY of April. Inasmuch as I am continually impressed by the ignorance of the general public, I was relieved to know that "the average American adult probably is not far from the eighth to ninth grade pupil in language usage."

I think you will agree with me, however, that to carry any weight, it is necessary for an article of this type to be grammatically perfect itself. Else why print it? There is one mistake in your test, which is glaring to me because it is such a common one—doubly glaring because the article attempts to urge the reader to avoid common errors. The thirty-second question

Its ratio of one horsepower to 37 pounds of car weight results in SUPERIOR PERFORMANCE

FOR ITS size and weight, the New Oakland Eight is the highest-powered car produced, only racing cars excepted. Its 251-cubic-inch engine develops 85 horsepower — one horsepower to every 37 pounds of car weight. This ratio explains why few cars can equal Oakland's top speed on the straightaway. It also explains why few cars can match its quick getaway in traffic or climb steep hills with such astonishing ease and swiftness.

Along with its *superior performance*, the car provides a high degree of smoothness. This is due largely to a short, rigid crankshaft which has no vibration period within the engine's speed — complete down-draft carburetion and manifolding resulting in smoother application of power — and mountings of rubber and laminated spring-steel which insulate the engine from the frame.

Your nearest Oakland-Pontiac dealer will tell you also about the remarkable gasoline mileage of this eight, which equals that of many sixes comparable in size. But only by driving can you get a true impression of Oakland's *superior performance* and exceptional handling ease. At the wheel you can learn, too, about its safety and the comfort of its smart Fisher bodies. Let a demonstration prove that General Motors' lowest-priced eight offers the many advantages of a fine eight-cylinder car at extremely moderate cost.

Seven body types. Prices f. o. b., Pontiac, Michigan, plus delivery charges.

OAKLAND MOTOR CAR CO., PONTIAC, MICH.

$1025 AND UP

PRODUCT OF GENERAL MOTORS

Write for an interesting booklet which illustrates and describes the design of the New Oakland Eight.

The New OAKLAND

of this test contains the word "everyone." May I inform you that the correct usage is "every one"—two words, and not one? Likewise "no one," "any one," and "some one." These words should never be confused with "everybody," "nobody," "anybody," and "somebody," all of which are, in truth, one word.—D. B., New York City.

Today's Inventor Must Also Be a Prophet

SOME people are just unlucky. You recently described a marvelous super-speed stock ticker. It was perfected just before the stock market slumped down until a ticker with mighty few ticks could manage all the business. Then, there was the man who devised a superior hairpin and the next year women took to short hair. An inventor these days has to outguess the future as well as produce an invention.—A. R., Baltimore, Maryland.

Yes, But You See, There Aren't So Many

I SHOULD like to shake hands with E. B. M., for what he says about your magazine is the absolute truth. I admire you for publishing all the kicks against yourself. Most magazines would publish just what the boosters say. I think P. S. M. is the best all-around magazine published and I wish the chronic fault finders would stop reading it. One of these is P. M. O'H. Only people like him would stop to think about Gus's dinner. Doesn't he realize that there are a great many people wouldn't read those articles if it were not for the human interest side of them and the note of wisdom in all Gus says?—W. R. F., Pleasant Hill, Mo.

He Tried It and Knows It's True

REGARDING J. K.'s letter about building ship models while convalescing, let me say that he has discovered an ideal form of recreation. I say ideal because in this modern day, when most of us use our hands and backs not at all, making anything for pleasure both rests the mind and helps keep the muscles of the body toned up. Which also applies to I. C. E.'s idea of fixing it. I forget who said, "The best form of rest is change of occupation," but I've found it true.—E. V. W., Norwood, Ohio.

First Bid for the $10,000 Science Prize

WAS delighted to learn through Charles F. Keale, Jr.'s article that air maps now aid stragglers to find their way in that labyrinth-like section of your city, Greenwich Village. Last time I visited New York I wanted to call at a certain place in the Village. I took a taxi in lower Fifth Avenue. The driver, who had no air map, required forty minutes to reach the designated spot which was about six squares away. How about giving your $10,000 prize to the inventor of the air map?—C. F. L., Akron, O.

Do You Favor Peace Memorials?

YOUR idea of awarding an annual prize to men of outstanding achievement in human service is splendid. The world has been thinking too much about war and the soldier. The achievements of peace are infinitely better and greater. In working toward permanent peace, it will be necessary to combat the "war-mindedness" of the world. Sometime ago it struck me that it would help to fix people's thoughts on peace to build a great memorial to all who have helped civilization go forward. My idea is that a start could be made by getting contributions for such memorials. What do you think?—W. W. N., Altoona, Wash.

Were Monks Killed by Falling Stars?

IT WILL be necessary, in your next revision of "The Pocket Guide to Science" to correct a statement in the paragraph on "Falling Stars." In Humboldt's "Cosmos," Vol. 8., page 156 (Bohn), appears the following:—

"Notwithstanding that for more than two thousand years the annals of different nations had records of falls of meteoric stones,—notwithstanding the fact of the companions of Cortez having seen an aerolite at Cholula which had fallen on the neighboring pyramid—notwithstanding that Caliphs and Mongolian chiefs had caused swords to be forged from recently-fallen meteoric stones,—nay, notwithstanding that several persons had been struck dead by stones falling from heaven, as for instance, a monk at Crema on the 4th of September, 1511, another monk at Milan in 1650, and two Swedish sailors on board ship in 1674, yet this great cosmical phenomenon remained almost wholly unheeded until attention was drawn to the subject by Chladni."

Chladni was a German physicist, living from 1756 to 1827.— E. W. B., North Loup, Nebr.

Another Booster for Esperanto Talkies

IN YOUR February issue of POPULAR SCIENCE MONTHLY you have an article on page 66 entitled "Wanted—An Automatic Linguist." It may interest you to know that both the Paramount Lasky Corporation and Metro-Goldwyn-Mayer have made talking films in Esperanto, the international auxiliary language, with good results. Esperanto is bound to become the official movie language of the world. It is an easy language to learn and is spoken in all countries of the world.—A. F. D., Milwaukee, Wis.

Cash Fails and Moon Goes Glimmering

WHAT has become of that German fellow—Oberth, I think his name was—who was going to shoot a rocket to the moon? I read about it in POPULAR SCIENCE a few months ago. He seems to have dropped out of sight.—G. H., Middletown, N. Y.

Prof. Herman Oberth, who proposed to fire rockets across the Atlantic and possibly to the moon (P. S. M., Feb. '30, p. 41), has postponed his trials. A German film company, making a moon-rocket picture, was financing his experiments. Before he was ready for the big test, the film was completed.—The Editor.

Block Puzzles Are Just His Hobby

I AM in favor of puzzles of all sorts, mainly block puzzles. One of the first things I look for in your magazine is the puzzle column. I have twenty or twenty-five different block and wire puzzles made, which I copied from your book, and the ones published in the March issue of POPULAR SCIENCE MONTHLY will make even more.—J. R., Brooklyn, N. Y.

Dublin Loses First Tire Honor

IN YOUR March issue you print an article on "The First Pneumatic Tire." I was a spectator of some of the tests referred to in that article and discussed many of the problems encountered in its early stages with the men who were working on it. The writer, however, makes a grave mistake, as the city in which all this occurred was not Dublin but Belfast. I was a resident there at the time and know.—A. A. F., Butler, Pa.

You're Right; They Are Wonderful

I AM one of the many model builders who have been building models from POPULAR SCIENCE blueprints. I have all of the ship model blueprints, which I think are wonderful. —J. L., Wallingford, Conn.

Australia Sends a Fresh Bouquet

I HAVE been reading your magazine for years and I can truthfully say that I have got as much out of it as I could out of a school education. I must lift my hat to you American publishers. Your work is the goods. When will you give us an article on the talking picture? I am greatly interested in the technical side of this work.—F. H. K., Charlton, Victoria, Australia.

That Diagonal Board Rouses Mathematicians

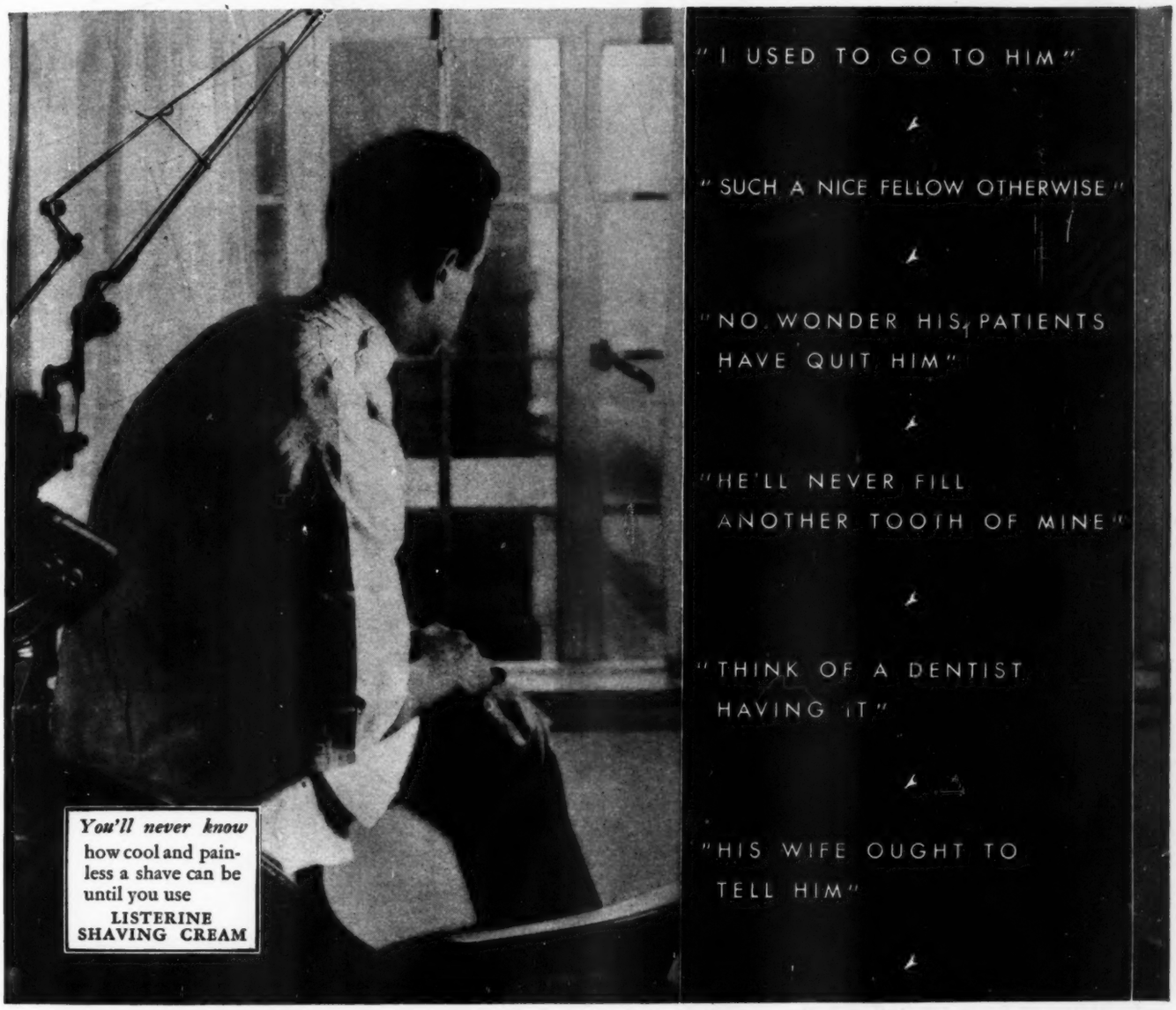
ABOUT F. L. H.'s problem of the board in the room sixteen by twenty feet. The board, twelve inches wide, would be 24.813 plus feet long.—R. C. M., Bristol, Conn.

Other answers received gave the board as 24.05 feet, 24.633 plus, 24.64, 24.81 plus, 24.61 plus, 21.1638, 24.74 plus, 23.16, 24.75 plus. The "twenty-fours" have it, but the fractions seem to be slightly up in the air.—The Editor.

We Have Magic Almost Every Month

I CAN honestly state that POPULAR SCIENCE MONTHLY is the best magazine I have ever read. In the March issue I greatly enjoyed the article on hypnotism. I should like to suggest that you devote a section of the magazine to simple scientific magic tricks.—L. R., Toronto, Can.

The whispers he never heard . . .


"I USED TO GO TO HIM"
"SUCH A NICE FELLOW OTHERWISE"
"NO WONDER HIS PATIENTS HAVE QUIT HIM"
"HE'LL NEVER FILL ANOTHER TOOTH OF MINE"
"THINK OF A DENTIST HAVING IT"
"HIS WIFE OUGHT TO TELL HIM"
You'll never know how cool and painless a shave can be until you use LISTERINE SHAVING CREAM

One of the most expert young dentists in New York, with a wonderful practice and a brilliant future—*then, one by one, his patients began to go elsewhere.* It was beyond his comprehension, this sudden change in his fortunes. Could he have overheard the whispered remarks of his former patients he would have realized instantly what the trouble was. But no good friend, much less a patient, is willing to inform a man that he has halitosis (unpleasant breath).

It is one of those delicate matters people simply do not discuss—an unforgivable fault in business, professional, and social life. And inexcusable too—because it is a fault that can be corrected almost instantly.

Do they say it of you?—*probably*

No man or woman has any right to assume freedom from this humiliating condition. It is so prevalent, so widespread, that it has been rightly termed "the national nuisance."

The insidious thing about it is that it does not announce itself to the victim. You yourself never know when you have it—and your best friend won't tell you.

The one way to make sure that you do not offend is to rinse the mouth with full strength Listerine every morning and every night, and between times before meeting others. Then, if halitosis is present, Listerine overcomes it. If it is not present, your mouth has had the benefit of Listerine's cleansing, antiseptic, deodorizing action.

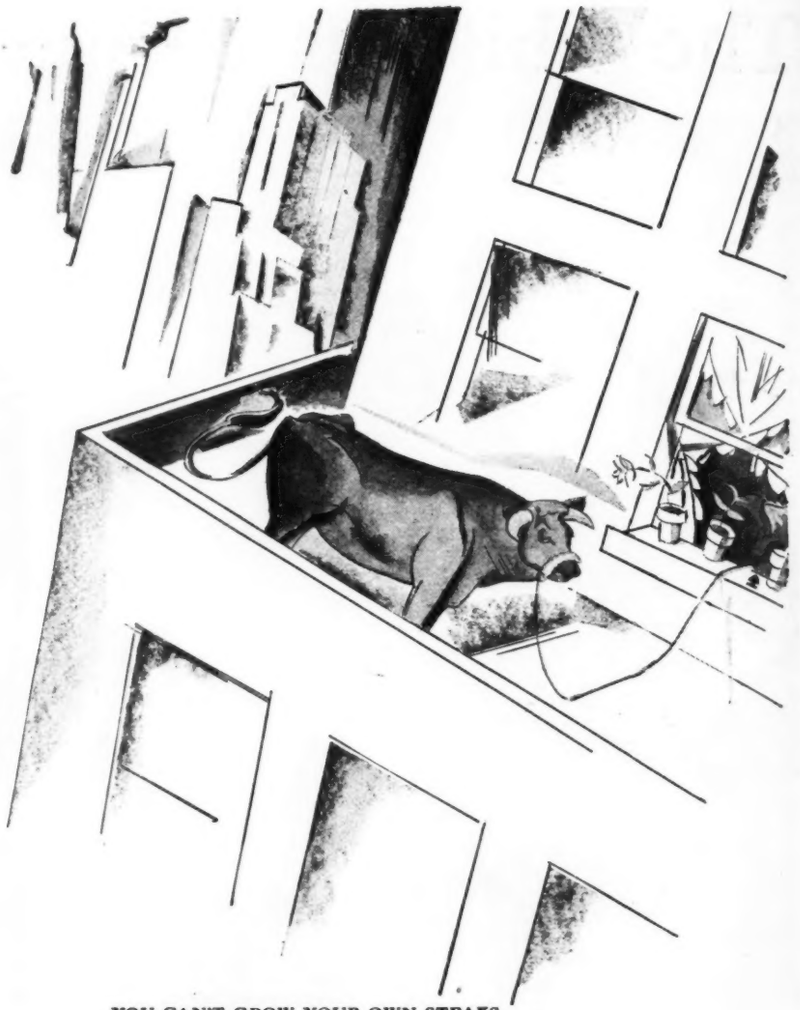
Halitosis is usually caused by fermenting food particles in the mouth, decaying teeth, unclean dentures, pyorrhea, catarrh, or other infections of the mouth, nose, throat, or gums.

Listerine's success against halitosis is due primarily to its antiseptic and germicidal action.* It allays decomposition and attacks infection. Since it is also a powerful deodorant, it instantly overcomes odors.

Keep a bottle of Listerine handy at home and office and use it systematically. It puts you on the healthy, polite, and fastidious side. Lambert Pharmacal Company, St. Louis, Mo.

Listerine *ends halitosis*

*Full strength Listerine kills Staphylococcus Aureus (pus) and Bacillus Typhosus (typhoid) germs in counts ranging to 200,000,000 in 15 seconds—(15 seconds is the fastest killing time accurately recorded by science.)



YOU CAN'T GROW YOUR OWN STEAKS . . .

The Amazing Adventures *of your* SIRLOIN STEAK

YOU can't grow your own steaks. They have to travel — hundreds, maybe thousands of miles — to arrive at your kitchen in time for dinner. And every foot of the way they must be protected from *heat*.

Steaks, nowadays, ride cool and comfortable, in refrigerator cars lined with Celotex. For Celotex keeps the temperature just what it ought to be . . . no matter what the weather is doing outside. Meats that travel with Celotex always arrive deliciously fresh and wholesome.

And when they reach your kitchen, does Celotex leave them in the lurch? No! For 36 leading manufacturers of household refrigerators are lining their cabinets with Celotex — to provide the icy atmosphere every steak appreciates.

We do not ask you to buy a refrigerator car — or to insist that your steaks have this traveling protection. For 9 out of 10 of the *new* cars are now insulated with Celotex.

But we *do* want you to insist that your new household refrigerator be insulated with the special kind of Celotex fabricated for this special purpose.

We want you to appreciate that when the retail salesman sells you a Celotex-insulated refrigerator, your steaks and all other perishable foods will enjoy the last word in protection.

The Celotex Company, 919 North Michigan Avenue, Chicago, Ill. In Canada: Alexander Murray & Co., Ltd., Montreal. Sales distributors throughout the World. Reliable dealers can supply Celotex Standard Building Board and Celotex Lath.

The word CELOTEX (Reg. U. S. Pat. Off.) is the trademark of and indicates manufacture by The Celotex Company, Chicago, Illinois

CELOTEX BRAND INSULATING CANE BOARD

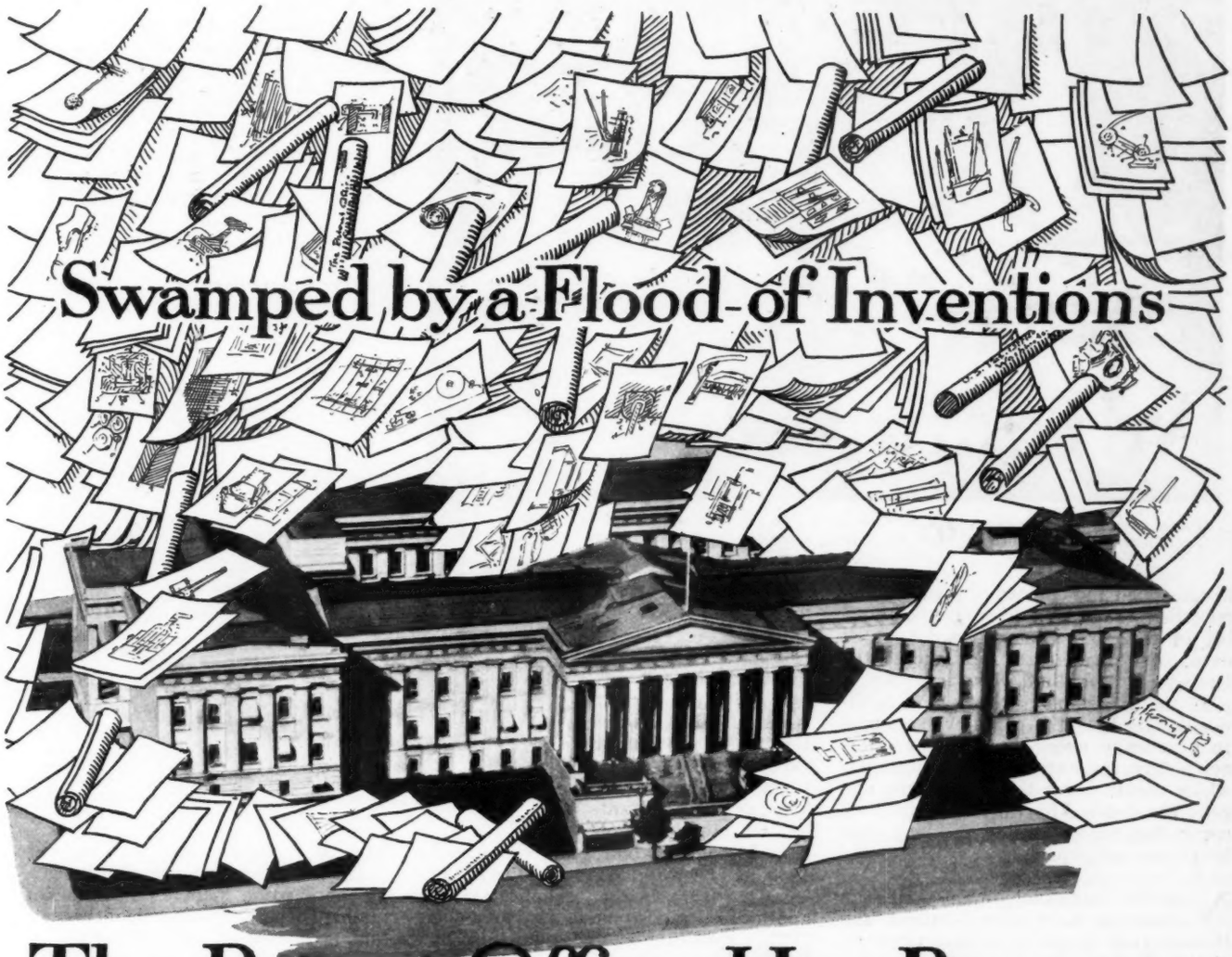
NATURE'S OWN REFRIGERATOR INSULATION

Popular Science MONTHLY

FOUNDED 1872

FIFTY-NINTH YEAR

JUNE, 1930 TRAVIS HOKE *Editor* VOL. 116, NO. 6



The Patent Office Has Become *A National Disgrace*

By EDWIN W. TEALE

THE Patent Office, in Washington, D. C., recently sent to a workman in a chemical factory in the Middle West a $100,000 piece of paper that wasn't worth a cent.

It represented a patent on a machine he had invented two years before. Factory officials, at the time the application was made, estimated that the invention would be worth $100,000 to them as soon as a patent was obtained. The workman visioned himself on Easy Street. But he reckoned without delays at the Patent Office.

His application was sent in on February 16, his patent attorney told me. Spring came and went. The Fourth of July passed. No word from Washington. The chemical industry was moving fast. New processes were appearing all the time. Unless he could get his patent soon, changes promised to make his invention valueless. He wrote to the Commissioner of Patents. A letter came back telling him that work was so far behind it would still be months before the examiners could get to his application.

It was nearly Christmas when a letter arrived from the examiner asking for information that required the revision of one of the claims. The inventor replied at once, expecting to get his patent immediately. Again dragging months passed. Again he wrote asking the cause of the delay. He was informed that the examiner's request for additional information automatically put the application at the end of the list, and it could not be considered again until all the applications that had come in during the ten months it had waited before its first examination had been disposed of.

The following fall, nearly two years after the first application was made, the patent was granted. By then, changes in the particular branch of the chemical industry to which it applied made the invention worthless.

This is only one of many examples of how inventors are

Patent attorneys search the records for their clients. In this room, they can examine patents already issued but can learn nothing about the 118,000 cases on file.

handicapped and cheated of their rightful rewards through long delays in the granting of patents. Undermanned, out of date, with inadequate equipment, the United States Patent Office is trying to meet the conditions of today with facilities designed for the needs of years ago. In practically every large patent attorney's office, there are on file patent papers which clients never bother to come and get. The demand for the inventions they cover disappeared during the long wait for the patent papers.

NOBODY knows how many American inventors have seen fortunes slip through their fingers because of tardiness at Washington. The number must reach into the thousands. If others are to be spared similar experiences, drastic action is necessary to speed up the machinery of the Patent Office.

As this is written, there are nearly 118,000 applications for patents piled up in Washington in the greatest jam of history. And new ones are pouring in at the rate of approximately 2,000 a week. In the last four years, the number of applications awaiting action has leaped from about 41,000 to nearly three times that number, about 118,000. These piled-up applications contain more than twenty-three acres of paper.

At present, the staff of examiners is gaining on this accumulated mass of applications at the slow rate of about 250 a week. Even if they continue to work at top speed, without vacations, it is estimated that it will take the present staff until 1942 to catch up with their work so they can give the inventor a reasonably prompt decision upon his application. As it is now, forty-five percent of all patents, or approximately every other one, take longer than two years to obtain. Some take several times that period.

I have before me, as I write, the current issue of the Official Gazette of the Patent Office, a weekly bulletin in which patents are listed as they are granted. Opening it at random, I find one patent, granted in March, 1930, had been applied for in March, 1923—seven years before. Application for another had been made in November, 1922, eight years before; and a third had been waiting final action since July, 1919—for eleven years! Scores of others had been lying in the Patent Office from five to seven years.

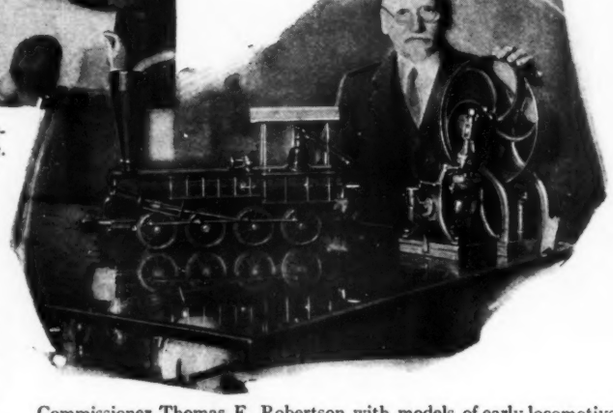
It has been estimated that the average inventor does not receive enough money from his invention to pay the forty dollars in fees charged by the Patent Office. These fees, paid at the time the application is filed and when the patent is issued, are, of course, additional to the fees which the inventor must pay his patent attorney. One of the contributing reasons for this situation is the delay in getting the patent.

AN EXAMPLE of the injustice of the present system is seen in the experience of a Brooklyn, New York, mechanic, related to me by his patent attorney. He invented a ventilating device and was promised backing by a man who had money to invest. However, after waiting a year to have the patent granted, the investor declared he could wait no longer and abandoned the enterprise.

Another patent lawyer told me of a similar experience. A Pennsylvania inventor was promised $10,000 for the promotion of an improved type of wrench which he had designed. After two delays of ten months each, the backer met financial reverses and the possibility of getting someone else to finance the invention, when it finally gets out of the patent mill, seems remote.

BUT even more discouraging to the inventor is the freedom with which infringement may take place during the long wait. An application for a patent affords no legal protection to an inventor. Only when the patent is actually granted can he prosecute in the court anyone using his idea.

In Connecticut, not long ago, an inventor waited for almost three years for a patent upon an automobile lighting device. Thinking his patent would be granted within a few weeks at most, he wrote to an automobile accessory manufacturer in an effort to sell his invention, submitting a description of it. A few days later, he received a note from the Patent Office. It suggested certain changes in his application papers. This meant a further delay of many months in obtaining the patent. All during this time, the manufacturer to whom he had submitted his device made and marketed a similar appliance, applied for a patent on it, and labeled his product with the words: "Patent Pending." The inventor was helpless. He could not prosecute until his patent was granted. When it was, the manufacturer ceased making the device. Had he continued its manufacture after the patent was issued, the inventor could have sued him for infringement. Even then, under the present law, the inventor could not have collected damages for the use of his idea before the day his patent was granted. His right to sue for infringement began when he received his patent, not when he made his application.



Commissioner Thomas E. Robertson with models of early locomotive and engine. Now their inventors would wait years for their patents.

IN STILL another way, the piled-up arrears in the Patent Office increase the difficulties of the American inventor. Suppose you have finished working out an idea for a patent. The first thing your lawyer does is to make a search to see if there are any similar inventions recorded among the more than a million and a half

patents already granted by the United States. He finds none, so you file your application.

This does not mean, however, that another person has not sent in an application for a patent on the identical idea before you. It may be among the 118,000 applications awaiting examination. No one in the world, not even the Commissioner of Patents himself, knows what inventions are described on those acres of paper. When your application is finally taken up by the examiner, you may learn that a patent had been applied for on the same idea nine months before you and the other application had not been reached when you made yours.

In such a case, the twenty-dollar application fee you paid the Government; the search fee, anywhere from five to a hundred dollars, which you gave the lawyer; and the attorney's fee might as well have been thrown into the street.

Yet, while the Patent Office has been giving poorer and poorer service and has been losing money for American inventors, it has been piling up for the Government a profit of more than six million dollars!

In fact, it is one of the few Federal bureaus that operates at a profit. Over a long period of years, its income has far surpassed its expenditures, although recently it has been running behind. However, from fees paid by inventors alone, $3,000,000 was collected by this office last year.

The photostat department of the Patent Office clears $40,000 a year, but this profit cannot be used, under the law, to reduce the patent jam.

A small part of the twenty-five miles of shelving, holding printed copies of patents. Left to right, Congressman A. H. Vestal, Chairman of the House Committee on Patents, J. A. Brearley, Chief Clerk of the Patent Office, and Commissioner Robertson.

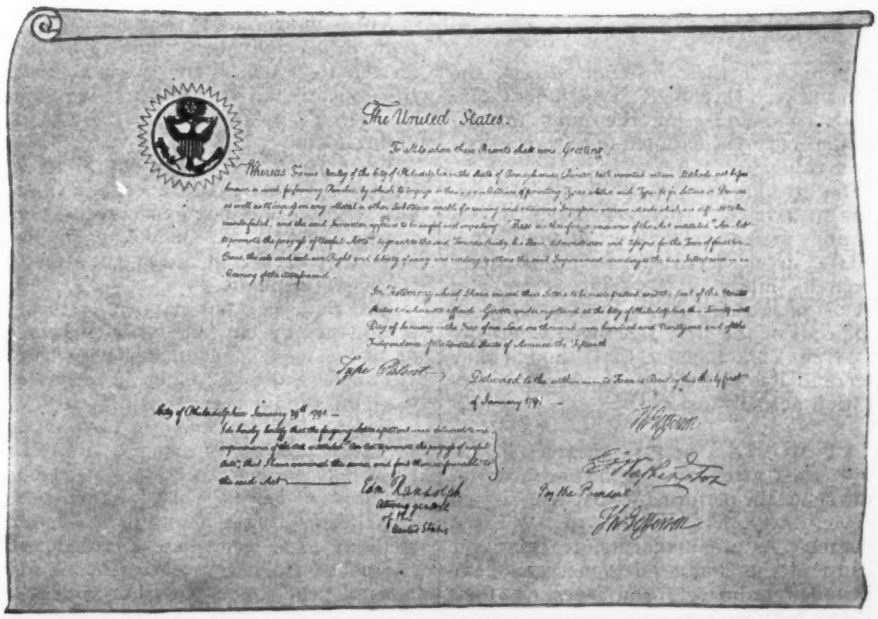
In the photostat department, where copies of patents are made, a profit of $42,000 was made in 1929. In these rooms, eight machines operate from morning until night, turning out between 3,500 and 4,000 photostats. Every time they click, the revenue of the office is augmented by twenty cents. The 118,000 applications, awaiting action at this time, represent an investment in fees by inventors of more than $2,000,000—an investment with admittedly insufficient returns.

If the Patent Office is making money, why doesn't it hire enough men to do its work? That is a natural question, one of many mystifying angles of this patent muddle for which I have sought the answer. I have talked with the Commissioner of Patents, Thomas E. Robertson. I have discussed the situation with many men employed at the Patent Office. I have interviewed lawmakers who have investigated the work of the Office and patent attorneys who have been dealing with it for years. And the result is the belief that the present disgraceful conditions will continue indefinitely unless the readers of POPULAR SCIENCE MONTHLY and others who are interested demand Congressional action that will give American inventors the service to which they are entitled.

In answer to the question above, I found that not one penny of the millions of dollars profit made by the Patent Office has been available for improving the service of the organization or for providing better equipment. The law provides that any money surplus at the end of the year must be turned over to the United States Treasury. Thus the Patent Office has never been able to put its profits to work. It has been dependent upon the whim of Congress for the amount of money it could spend.

A BILL is now before Congress to increasethe number of examiners by one hundred and ten. In order to do this, it is proposed to raise the filing fee for patent applications from $20 to $25 and the final fee a like amount. This means that the inventor will have to pay $50 instead of $40, plus the necessary attorney's fees and other expenses, to get his patent. If it also means that delays will be eliminated, no one will object. But does it?

Everyone with whom I talked in the Patent Office agreed that the hiring of the new examiners would be of little immediate aid in clearing up the colossal "log jam" of applications. It will be two and a half years, at least, before they will be of much help. In fact, some thought that for that length of time, because of their inexperience, they will (*Continued on page 132*)



Reproduction of the oldest patent grant in the files at Washington. It is signed by George Washington and Thomas Jefferson and was issued to one Francis Bailey, of Philadelphia, in January, 1791.

Amos 'n' Andy Explained

By A. A. BRILL, M.D.
As told to Michel Mok

DR. A. A. BRILL is known as the ablest man in his field in this country. He brought psychoanalysis to America and has written two widely read books on the subject. In this absorbing article, he brings all his vast knowledge and experience to bear in an effort to show you exactly why the Amos 'n' Andy craze is now sweeping the country. He goes to the very heart of the matter and makes clear the secret of their great popular appeal.

Amos 'n' Andy in black-face, as they appear for a theatrical engagement. In the background are McIntyre and Heath, the "Georgia Minstrels," who for more than half a century did an act similar to that of Amos 'n' Andy.

I DISCOVERED, not long ago, a new phenomenon in American life.

Literally millions of persons of all ages and stations are listening daily to Amos 'n' Andy, the "comic strip of the air." But they do more than that. They take an intense personal interest in the two characters, their ups and downs, their adventures. To thousands of men, women, and children Amos 'n' Andy are not fictitious figures. They are real, living human beings.

From the psychological point of view, this struck me as so remarkable that I decided to make some further investigation.

In recent months, I found, the Amos 'n' Andy popularity has grown into a veritable craze until now it is safe to say that, outside of the President of the United States, they are the best-known men in this country and perhaps the best-liked. As a matter of fact, it is a standing rule at the National Broadcasting Company that nothing is allowed to interfere with their program except the President, other high Government officials commandeering the radio for announcements of national importance, and SOS calls.

So anxious are persons in all walks of life to hear them that telephone conversations in the eastern part of the United States have decreased to an unprecedented minimum between seven and seven-fifteen, the Amos 'n' Andy period. Officials of the Bell Telephone Company in New York told me that, though they were unable to compute figures, the condition actually existed.

AT MOVING picture theaters in the East, attendance at the so-called supper show, the performance between six and seven-thirty, has dropped to a marked degree. Astute managers, realizing the cause of the trouble, in some cases have installed radio sets and interrupt their shows between seven and seven-fifteen to give their patrons the benefit of the Amos 'n' Andy broadcast. This, however, is not a lasting solution of the problem, as a question of copyright is involved.

In social life, too, the team has made its influence felt. People refuse point-blank to attend seven-o'clock dinners unless the host assures them that he owns a radio. Between seven and seven-fifteen, radio stores in eastern towns and cities are crowded with persons who drop in from the street to hear their favorite comedians. In brief, the nation, in a manner of speaking, pauses while Amos 'n' Andy are on the air.

IN THE business world their effect also has been noted. Leaders in the radio industry report that, in the last few months, the Amos 'n' Andy craze has been responsible for a considerable increase in the sale of radio sets.

Not long ago, a traveling man told me that, in a small Massachusetts town in his territory, one of the two hotels captured nearly all of the traveling salesmen's trade by installing a radio in the dining room.

When the team makes one of its infrequent personal appearances at a vaudeville theater, all box office records are smashed. And the men are mobbed when they are recognized on the street or elsewhere in public.

But this does not happen often, for few of their ardent fans know their faces or real names. Their names are Charles J. Correll and Freeman F. Gosden. Correll is Andy; Gosden, Amos.

Recently, the pair made a personal appearance at West Orange, N. J. At the close of their act, they were rushed by automobile to New York for their usual second broadcast. They were arrested for speeding. The comedians pleaded with the policeman not to delay them. Millions of people, they told him, would be disappointed if they did not reach New York City in time.

"Who are you, anyway?" asked the cop.

"We are Amos 'n' Andy."

The policeman smiled. "You can't kid me," he said. "Tell that to the judge."

Correll and Gosden exchanged a significant glance. They began talking in their dialect. At once the cop was convinced and released them with profuse apologies.

And that brings me to the question of the Amos 'n' Andy "lingo." Perhaps the most striking evidence of their immense popularity is the fact that they are influencing the language. Persons in all walks of life are using their pet expressions. "I'se regusted" is heard on every hand. Men and women who never employed such phrases before now interlard their conversation with, "ain't dat sumpin?" and "Check and double check." Staid business men say and write "propolition," instead of proposition, in their talk and correspondence.

BRIEFLY, then, we are confronted with a phenomenon the like of which has never been known before anywhere. What is the secret of Amos 'n' Andy's tremendous popularity? How do they work their spell over millions? What makes their appeal so universal? They are not the best comedians ever to appear in this country. They are not the first "black-face" comedians, nor the funniest. Their material is not strikingly original, and neither are their methods of presenting it. What then, is the mystery?

I have asked dozens of people why they liked them. Usually, the answer was a smiling, "I don't know." A few replied, "Why, because they are funny." Others answered, "Because they are so human." One intelligent man said: "You sit in your chair for fifteen minutes, forget everything, and just laugh."

Strange as it may seem, that, in a nutshell, was the correct answer, though the man scarcely suspected that his answer was correct. But the matter is a little more complicated than that.

In trying to find the reason for anyone's popularity, it is necessary first to ask: In what does he excel? What is his specialty? In this case, the answer is: wit. Amos 'n' Andy's specialty is that they seem to have an almost uncanny ability to make people laugh.

Now, from the earliest civilized times, those possessing that particular gift have been the darlings of humanity. They were forgiven anything. The court jester of olden days could be as impudent as he pleased; so long as he amused the king, he was immune from punishment.

WHY are funny men such great favorites? Because wit, or humor, is one of the outlets civilized man has evolved to give vent to pent-up emotions that are otherwise tabooed. Through it, he obtains release from repression and oppression; and escapes, temporarily, from the stress of reality. Laughter is a narcotic.

I said "civilized man" advisedly. For primitive savages and small children have no sense of humor. A little child laughs merely because it sees an older person laugh; it is pure imitation. The emotion is transmitted, but not the idea.

As Bill Hay says every night, "Here they are"—Amos, left, and Andy, "in person," just as you would see them if you met them in the studio.

In children, a sense of humor begins to develop at the age of four or a little later. And it is noteworthy that at the same time the quality of the child's dreams undergoes a change.

Dreams are a function of the mind to keep our sleep from being disturbed. For example, if a man goes to bed hungry, he might wake up in the night needing food. But his mind takes care of him. He dreams that he attends a dinner, where he is given plenty to eat.

The mechanism of dreams and of wit or humor is essentially the same. Humor and wit are nothing but modes of obtaining pleasure from a distortion of words and ideas. Like dreams, wit is one of civilized man's means of freeing himself from oppression, and of realizing his desires, especially the forbidden ones, in a disguised, concealed way. This is the secret of the appeal of all comedy, including the particular brand dispensed by Amos 'n' Andy.

One of the elements of their success, then, is the lure of the forbidden. "But they are as innocent as the day is long!" I can hear you protesting. "Why, one of the beauties of their stuff is that it is absolutely clean."

Right. But a great many things are forbidden in civilization that are not unclean in the least. One of these is to talk improperly. From the time we are children we are told constantly to speak correctly. If we do not, we are punished.

BUT there was a period in earliest childhood when we were free from this repression of civilized life. When we were very small, we were allowed to pronounce any word as we wished. More than that—the very speaking of words brought immediate results. All a baby has to do is to say "apple" and mother gives it the desired object. But it does not even need to say "apple." Suppose the youngster pronounces it "bapple." Mother understands and gives him what he wants just the same.

As a result, little children believe in what is called "the omnipotence of thought," meaning that they believe that it is sufficient to think a thing and it occurs. From this belief we suffer a rude awakening when we are three or four years old. But all through our subsequent lives we unconsciously long to return to the happy, carefree days of childish babble. (*Continued on page 120*)

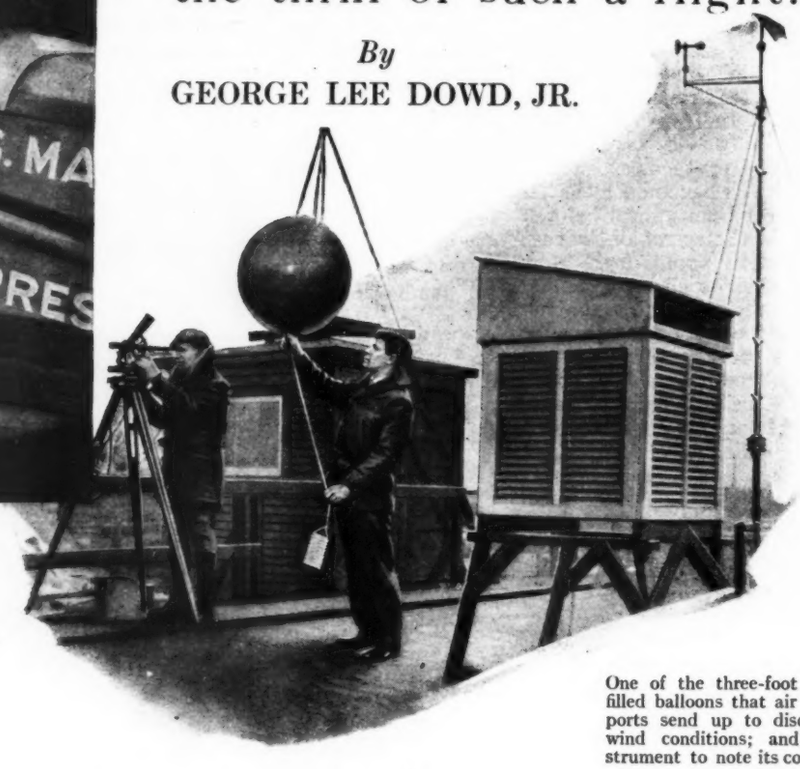
"Fresh Air Taxicab" toy contains Amos, Andy, and their dog.

Midnight-*the* Mail Flies West!

Do you want a ride through the black night in a swift mail plane? As you read this vivid article, you'll get all the thrill of such a flight.

By
GEORGE LEE DOWD, JR.

Just before the take-off. Field manager and pilot check their watches—for the mail must go through on schedule.



One of the three-foot gas-filled balloons that air mail ports send up to discover wind conditions; and instrument to note its course.

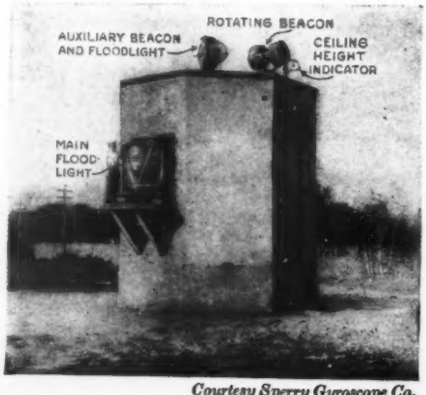
A BLUE band of solid flame shoots from an exhaust into the darkness. Red sparks of burning carbon stream out and disappear in a roar of wind from a racing propeller. At the end of a steel chain, a biplane tugs, the deep-throated exhaust of its Liberty motor shaking the hangars. Mechanics at Hadley Field, N. J., are grooming one of the huge nocturnal birds for a flight west with the midnight mail.

Encircling the 160-acre field is a necklace of alternating red and yellow boundary lights. To the north, four glowing rubies of neon gas mark the location of dangerous obstacles—a farmhouse, barn, and silo across the road and the floodlight building at the edge of the field. High on one of the hangars, a revolving beacon wheels its ten-mile arms of light across the sky.

This is the scene familiar to workers at this eastern terminal of the transcontinental air mail. I witnessed it for the first time recently when I drove over from New York City to spend a night at the famous airport. In the largest hangar, I found W. H. Maxwell, the boyish-looking field manager of the National Air Transport, who was to show me about this home-nest of the night-flying planes.

In the big building squatted six silent machines. Some were blue-bodied Boeings with Hornet air-cooled motors, forty-eight-foot silver wings, and round, blunt noses like dragonflies. Others were solid-looking, hard-hitting Douglas ships with huge Liberty engines that give 300,000 miles of service for every forced landing. The upper surface of the top wing on every plane is painted yellow so it can be seen against the snow in the event of a forced landing or a crash.

Near the door was a bright yellow Pitcairn Mailwing, dwarfed to a pygmy by the bigger planes around it. It is used, Maxwell told me, to ferry mail back and forth between Hadley Field and Newark Airport. The flyers call it the "puddle-jumper." It is the "promotion ship" on which new pilots are initiated into the work before they begin "pushing the mail" to Cleveland and points west. It carries 600 pounds of cargo, about half the capacity of the larger ships. Yet this load was the maximum carried by the largest machines when the transcontinental air mail was organized in 1924.



Courtesy Sperry Gyroscope Co.
Typical lighting outfit of an air mail terminal. Auxiliary beacon has 30,000,000 candlepower.

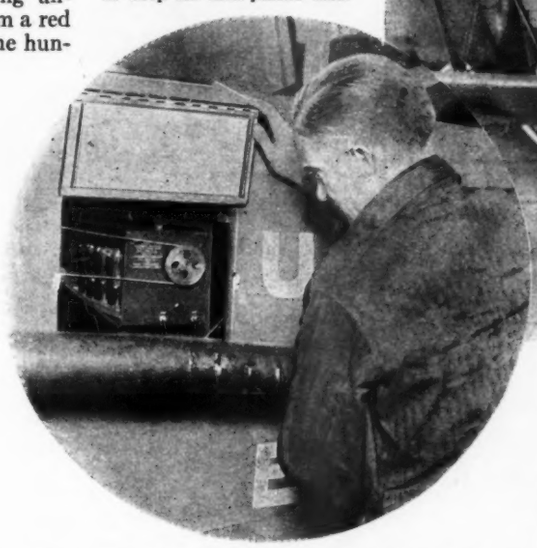
A few months ago, one of the pilots, having his try at the "puddle-jumper," came in after midnight. He winked his landing lights as a signal to illuminate the field. The lighting operator didn't see him. The pilot thought he would scare him by zooming over the floodlight house with motor wide open. Just as he swooped low over the field to have his fun, the lights went on. Blinded, he flew into the ground at an angle. He hit like twenty airplanes. But the stout little ship held together and bounced like a rubber ball. The pilot circled the field and set her down like an egg crate. He expected her to fall apart when she touched the ground. But the extent of the damage was a bent propeller and a broken bracing wire.

Wearing khaki overalls, with a red arrow piercing the letters N. A. T. on the backs, a dozen mechanics were checking over the planes in the hangar. One man spends all his time washing the ships.

©Karl Photos

This remarkable photograph shows how the powerful airport floodlights turn night into day as the armed men, constantly alert for the unexpected, go about the task of loading or unloading mail.

At right, one of the planes is getting a thorough inspection. This suggests the care and diligence exercised in an effort to keep the mail planes safe.



One man at Hadley Field, N. J., airport spends his time keeping in perfect order the planes' radio outfits.

Another does nothing but test and care for the radio equipment. Others are expert motor doctors, and still others are riggers who check over and trim the ships. At the Chicago field of the N. A. T., there is a "propeller man" in charge of adjusting all "props," and at Cleveland a "parachute man" examines and repacks every 'chute once a month.

WHEN a plane arrives at Hadley Field, while the mail is being unloaded, the fuel tanks are filled from a red pump before the main hangar. One hundred and fifty-eight gallons pour into the big tanks of the Boeings and from 128 to 131 gallons into those of the Douglas planes. When this is done, a motor expert runs up the engines, listening to their sound as a first check upon their condition. After that, the radio man climbs into the cockpit and, with motor wide open, listens through the pilot's headphones to see if the radio beacon signals can be heard easily above the noise of the engine.

On every machine, about five feet behind the cockpit, a single strut, like a five-foot wooden pencil, sticks straight into the air above the fuselage. Embedded in it is the copper wire that forms the aerial for the compact forty-pound receiving set in a compartment of the fuselage below.

After the ship is run into the hangar, it is gone over from propeller to tail. The batteries are taken out and tested. The eighteen-gallon radiators that cool the Liberty engines are examined and filled. When oil is changed, thirteen gallons of the best lubricant is poured in for both Liberty and Hornet motors. On the side of each plane, in big black figures, is its number. The Boeings were "66" and "72"; the Douglases "33," "29," and "27." All told the N. A. T. has approximately fifty planes in operation.

I climbed into the cockpit of "29." Rakish exhaust pipes, twenty feet long, ran back from the motor on each side of the fuselage. My head barely reached above the cockpit. Before me, the round, square, and oval faces of more than eighteen instruments and gadgets crowded the instrument panel.

ELECTRICAL switches allow the pilot to throw on and off the navigation lights, the landing lights, and the switchboard illumination at will. For emergency landings at night, trips at the side of the cockpit release the two parachute flares housed in upright "tin cans" that open at the bottom of the fuselage behind the cockpit. Near my right foot, a pistonlike plunger was attached to the floor. Above it, an arrow was painted pointing ahead with the words "Pyrene in." When a pilot kicks ahead that rod, an automatic fire extinguisher floods the engine compartment.

ONE night last November, a few weeks before he was killed, pilot Thomas P. Nelson was forced to kick ahead that piston in a hair-raising battle with death. Flying from Cleveland, fire broke out in the motor compartment. He cut the gas, thinking the blaze would die out. It increased. He kicked on the pressure extinguisher. The fire grew worse. The flaming ship was directly over a valley town. If he jumped with his parachute, Nelson feared, the plane would plunge among the houses below. So he stuck to the ship, guiding it toward a wild mountain ravine to the right. The flames had eaten almost to the 100-gallon tank of highly explosive fuel before he jumped —just in time. (*Continued on page 128*)

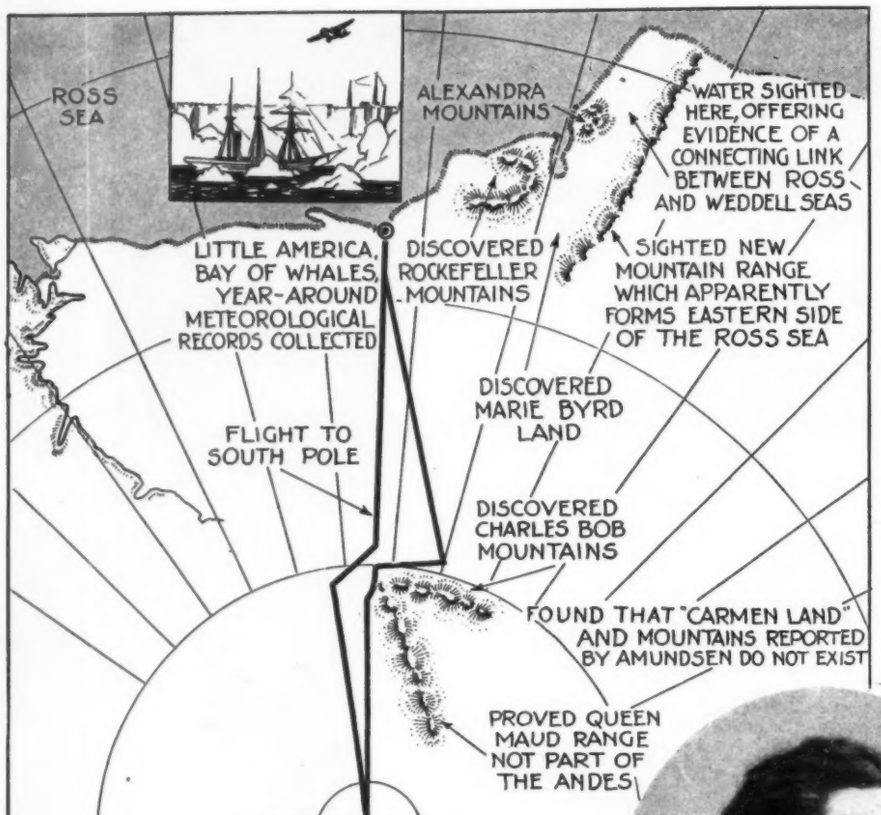

ROSS SEA
ALEXANDRA MOUNTAINS
WATER SIGHTED HERE, OFFERING EVIDENCE OF A CONNECTING LINK BETWEEN ROSS AND WEDDELL SEAS
LITTLE AMERICA, BAY OF WHALES, YEAR-AROUND METEOROLOGICAL RECORDS COLLECTED
DISCOVERED ROCKEFELLER MOUNTAINS
SIGHTED NEW MOUNTAIN RANGE WHICH APPARENTLY FORMS EASTERN SIDE OF THE ROSS SEA
DISCOVERED MARIE BYRD LAND
FLIGHT TO SOUTH POLE
DISCOVERED CHARLES BOB MOUNTAINS
FOUND THAT "CARMEN LAND" AND MOUNTAINS REPORTED BY AMUNDSEN DO NOT EXIST
PROVED QUEEN MAUD RANGE NOT PART OF THE ANDES
SOUTH POLE

Diagram showing work done and discoveries made during year and two months the Byrd party spent in the heart of the far South.

Many Sciences Aided by Byrd's South Polar Trip

Maps of Antarctic must be changed as a result of his explorations. Contributions are also made to radio, aviation, and meteorology.

AFTER a year and two months spent in the isolation of the Antarctic wastes, the Byrd Expedition is returning to civilization bringing new information concerning the mysterious, ice-covered continent which lies at the South Pole. Costing more than a million dollars and carrying the most elaborate scientific equipment ever prepared for a trip of exploration, the expedition collected data which will aid workers in many fields of science. Its accomplishments must be measured in terms of pure science, in the addition it has made to the sum total of classified facts at the command of men.

The first result of the expedition will be the remaking of maps of the Antarctic continent. At least three hitherto unknown ranges of mountains were sighted by Byrd and his companions on their flight to the South Pole and in subsequent trips to the east of Little America, as the main base of the expedition on the Bay of Whales was known. These mountains must be placed upon the maps. In the present atlases, "Carmen Land" appears to the east of the Queen Maud Range. Byrd flew in this region and discovered that the land and mountains which Roald Amundsen, the Norwegian discoverer of the South Pole, reported sighting in 1911 do not exist. Carmen Land must be left out of future Antarctic maps. Exploration flights were also made into the territory toward Discovery Inlet and into Marie Byrd Land, regions no one ever before had penetrated.

Additional information, of value to geographers, is contained in the aerial survey films by which 150,000 square miles of Antarctic territory were mapped. Accurate soundings of the depth of the water at points on the Bay of Whales were taken. The hypothesis, advanced by eminent geographers, that Ross and Weddell Seas are connected was further strengthened when Byrd sighted water in the depression east of the Alexandra Mountains. There has been much discussion as to whether the Antarctic is really a continent at all. Some geographers maintain it is a series of islands covered by ice. The observations made by the Byrd Expedition may have a bearing upon the final decision upon this moot point.

Knowledge of the geology of the Antarctic was increased by study of the Queen Maud Range. It was found that the character and structure of the rocks composing the mountains are entirely different from that of Graham Land and the Andes Mountains. This discovery is considered highly important by geographers, as it proves that the old hypothesis that the Queen Maud Range is part of the Andes is false. This theory maintained that the Andes extended through Graham Land into the Antarctic, ending in this range on the South Pole Plateau.

In the field of radio, the reliability and value of short wave sets for long distance communication was established. Daily reports of the activities of the expedition were flashed to *The New York Times*, which printed a full account of the different discoveries as they were made.

In natural history, many specimens of Antarctic life were obtained and the most complete data yet collected upon the habits of the seals, whales, and penguins that live in the South Polar regions were assembled.

©*World Wide Photos*

Rear Admiral Byrd on board the *Eleanor Bolling*, which docked at Dunedin.

Meteorologists in all parts of the world are interested in the first year-round weather reports from the Antarctic. The observatory established by the expedition made hourly records showing wind velocity and direction, barometric pressure, temperature, and humidity.

A direct connection between the weather in the Antarctic and the weather in many parts of the globe is believed to exist. For instance, meteorologists have observed that a severe winter in the South Orkney Islands, near the Antarctic Circle, means a drought three and a half years later in the Argentine wheat belt. If the Antarctic winter is mild, abundant rains and a fine crop result in the South American country.

They also link the Antarctic weather with the monsoons of India, and they believe it has much to do with the height of the flood waters of the Nile. Perhaps a study of the data collected by the Byrd Expedition will aid these scientists in a better understanding of how much of the world's weather is affected by the conditions near the South Pole.

How They Trailed a New Planet

Study of many photos of stars disclosed to a farm boy what may prove a new world where a famous astronomer said it would be. Old theories are upset by find.

By

ALDEN P. ARMAGNAC

A NEW planet has been announced. Out in space, four billion miles beyond the globe we live on, a yellowish object, a little larger than the earth, swings in a vast circle about the sun; a frigid little world, bathed in the dim light of perpetual dusk. Its discovery is called the most important event in astronomy in nearly a hundred years.

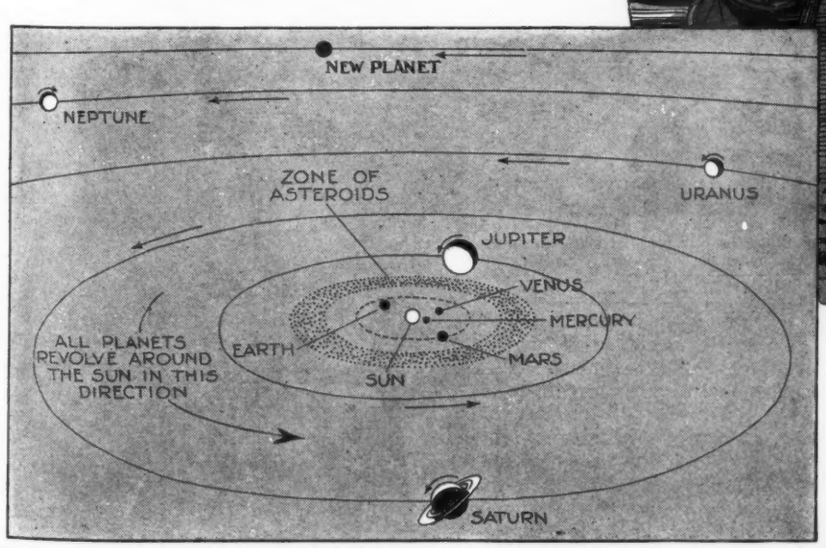
A new planet is not found every day. As many of us learned in school, a planet is one of the exclusive company of heavenly bodies that get their light and heat from the sun. They swing about it, as the earth does, in great circular paths, or orbits. These earthlike worlds are so few in number that they may be counted on the fingers.

Six, visible to the naked eye, were known to the ancients. In outward order from the sun they are: Mercury, Venus, Earth, Mars, Jupiter, and Saturn. Only two more, far-away Uranus and Neptune, were added comparatively recently when peering at the sky with telescopes came into fashion.

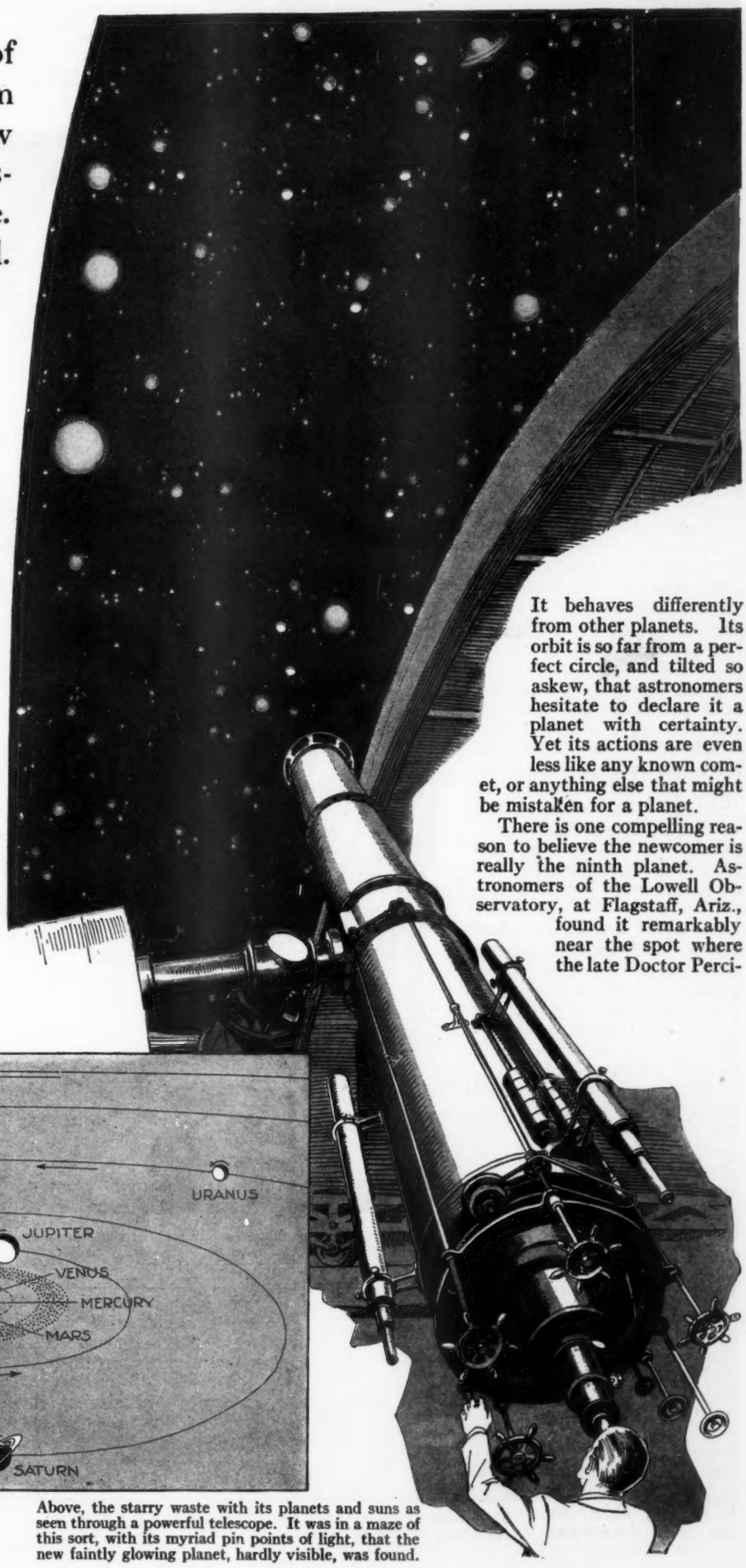
Now there is a ninth.

The ninth awaits positive confirmation. It behaves differently from other planets. Its orbit is so far from a perfect circle, and tilted so askew, that astronomers hesitate to declare it a planet with certainty. Yet its actions are even less like any known comet, or anything else that might be mistaken for a planet.

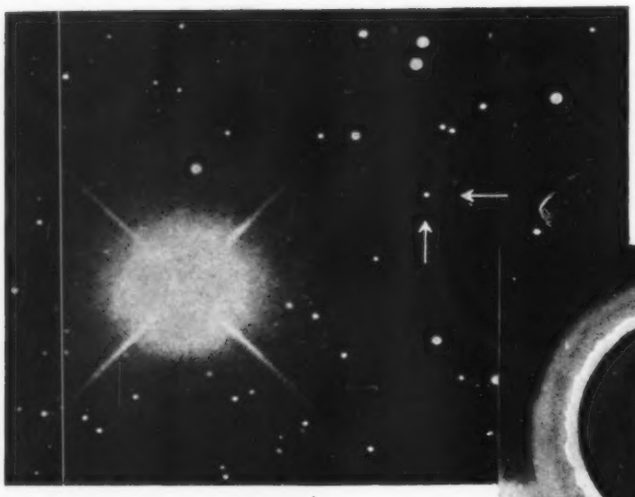
There is one compelling reason to believe the newcomer is really the ninth planet. Astronomers of the Lowell Observatory, at Flagstaff, Ariz., found it remarkably near the spot where the late Doctor Perci-



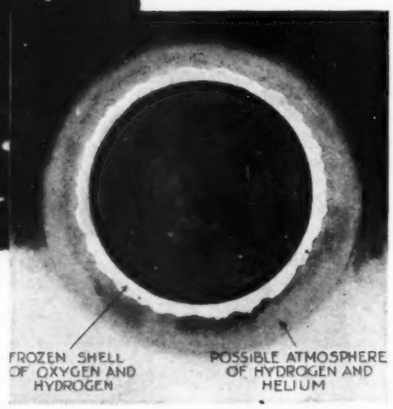
On the outer rim of the solar system whirls the new planet. This perspective view shows the planets in about the positions they occupied when the ninth member of the family was first sighted by man.



Above, the starry waste with its planets and suns as seen through a powerful telescope. It was in a maze of this sort, with its myriad pin points of light, that the new faintly glowing planet, hardly visible, was found.



Here is the new planet, indicated by the arrows, as seen in a photograph taken at Flagstaff, Ariz. The large disk of light at the left is a big star in the constellation of Gemini. Below, a suggestion of how the new planet would look to a near-by observer. It is too cold to have atmosphere like the earth's.



val Lowell, founder and director of the observatory, predicted it fifteen years ago. When Clyde Tombaugh, one-time Kansas farm boy who came to the observatory to study astronomy, spotted it as a flash of light on a photographic plate, the long search was believed ended.

Far away as the new planet is—so far that its light, racing through space at 186,000 miles a second, takes six hours to reach our telescopes—its discovery has practical significance for many besides the astronomers.

Even dictionary-makers and book publishers are upset by the discovery. At least two widely-used standard dictionaries felt safe in listing, to round out their definitions of "planet," the names of the first eight, without such qualification as "so far known." Now the dictionaries to be up to date must publish a new edition. Meanwhile, for a brief time, there are no complete books whatever on general astronomy. A New York publisher of school books told POPULAR SCIENCE MONTHLY that revised editions, probably available next fall, would describe the new planet.

Anyone who has ever had the curiosity to wonder where the earth itself came from is further concerned in the discovery of the new planet, for, astronomers say, it throws a new light on the way the earth was born. Its finding solves other long-standing mysteries of the heavens, too—for instance, wobbles in the motions of Uranus and Neptune, the two planets nearest to it, and strange delays of several days in the returns of Halley's comet, a flashy periodic visitor to our sky.

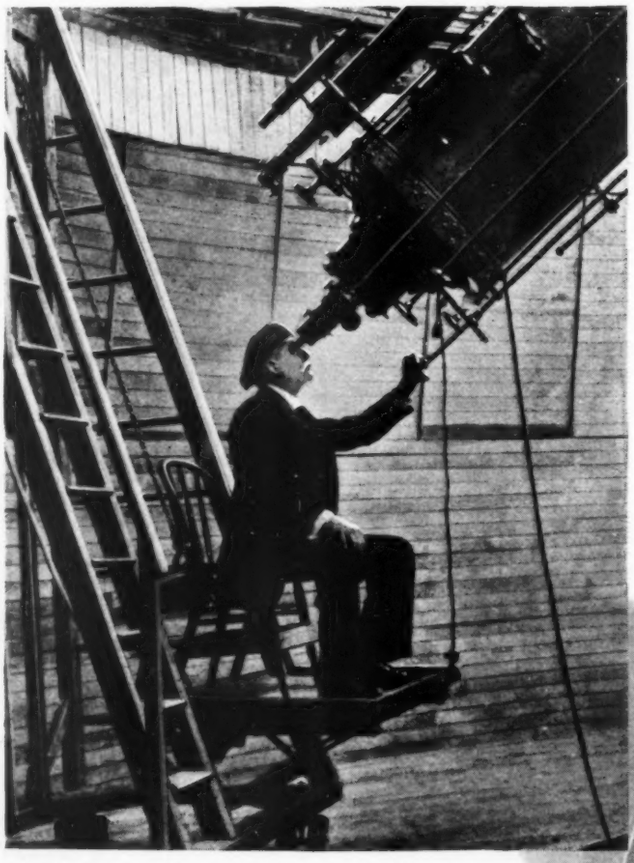
Yet the planet itself is no easy object to see. Few Americans will ever see it except in photographs. It is far too faint to be seen in the night sky by the naked eye; or, for that matter, through anything short of a sixteen-inch telescope such as a large observatory would possess. Even that would require good "seeing weather." Astronomers classify the planet as of the "fifteenth magnitude" in brightness, which would make it about a thousand times fainter than Neptune.

A concrete picture of this degree of brightness is suggested by Dr. Donald H. Menzel, of the Lick Observatory at Mt. Hamilton, Calif. If mountains, atmosphere, and the earth's curvature did not intervene, astronomers at the Lick Observatory could see New York, 3,000 miles or so away, through their great telescope. Then, if someone stood on top of New York's tallest building and held out a brick in his hand, the sunlight reflected from that single brick would appear about as bright as does the new planet in powerful telescopes. Another example of its brightness is that it corresponds to the light of a tallow candle seen at a distance of 430 miles, the approximate distance between New York and Cleveland, O.

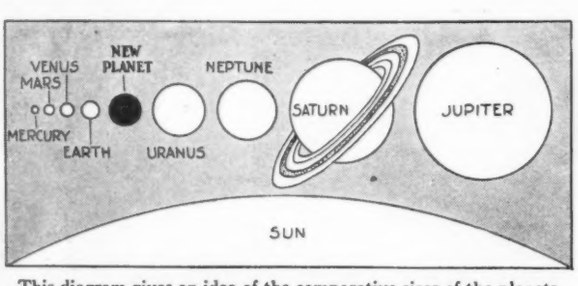
When such an object must be picked out from among some 30,000,000,000 stars in the sky, many of them far brighter, it is no wonder that the world's greatest observatories failed to notice it in the past.

It was picked up first at the Flagstaff observatory because Dr. Percival Lowell had built that lookout post and equipped the turreted dome for the sole purpose of finding it. This he did at his own private expense. He was sure of himself. Working with pencil, paper, and intricate equations, he had already

(*Continued on page 123*)



This rare photo shows the late Dr. Percival Lowell at the large telescope used at the Lowell Observatory.



This diagram gives an idea of the comparative sizes of the planets. Note that the new planet fits in between the earth and Uranus.

Clyde Tombaugh, 24-year-old astronomer, once a farm boy at Burdette, Kan., now studying at the Lowell Observatory, first saw the new planet.

NEW IDEAS AND INVENTIONS

On this and succeeding pages are described the latest achievements of inventors and novel applications of scientific progress

Lawson Robertson, track coach at the University of Pennsylvania, has developed this device to teach his sprinters the correct position and balance on the starting line. Robertson is steadying the cable.

TRACK DEVICE TEACHES SPRINTERS FAST START

SPRINTING stars are being developed through the use of a new invention by Lawson Robertson, famous track coach at the University of Pennsylvania, who was in charge of the American Olympic team in 1928. The new device consists of a steel cable with one end fastened to the ground and the other ending in a handgrip. The sprinter grasps this handgrip and leans forward until he finds just the right position to give him the greatest forward impetus, without stumbling, at the get-away. After the sprinter has learned the correct position for his body, he practices assuming this pose until it becomes the one he naturally adopts.

PREDICTS FLYING BOATS WILL OUST AIRPLANES

THE great heavier-than-air sky-liners of the future will be flying boats instead of land planes, Lieutenant Commander John W. Iseman, Editor of *The Aviation Manual*, told a recent gathering of aviation experts in New York City.

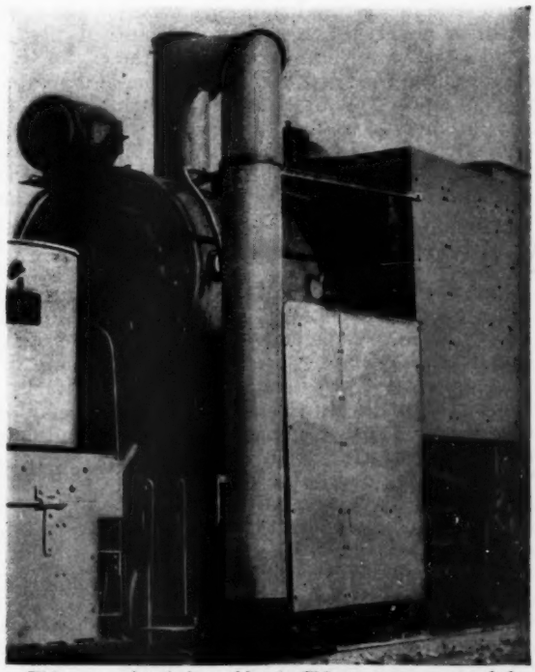
In carrying passengers, freight, and mail, winged boats have an advantage over land planes as, in most cases, they can land near the center of the city; at present airports must be located at a distance from the business district.

Other advantages which will result in flying boats being used wherever possible in place of land planes are: when over water, there is always an emergency landing field below; and, with practically unlimited landing area, flying boats can come down at higher speeds than land planes that must come to a stop within a limited area. As planes become bigger and faster, Commander Iseman says, the landing speeds will automatically increase.

CHINESE ENGINE HIDES ITS SMOKE

ACROSS the battered plains of war-stricken China, a curious armor-plated train rumbles, whose smokestack, instead of spouting a black column skyward, shunts it groundward through a cylindrical apparatus resembling an elongated stovepipe.

The smoke thus spreads out along the ground so that movement of the train cannot be detected from a distance. The peculiar armored train belongs to the army of General Hsu Yuan-Chuan, commander of the forty-eighth division of the Chinese Nationalist Forces. It is an interesting example of the "mechanization" of war in modern China.



This armored train is used by the Chinese army commanded by General Hsu Yuan-Chuan. To escape detection, it sends its smoke downward through the stovepipelike device.

SLIGHT MUSCLE FRICTION GIVES ATHLETIC SUCCESS

MUSCLES, like gasoline engines, need good lubrication and plenty of fuel, according to Dr. Charles Best, of Toronto, Canada, who worked with Dr. Frederick G. Banting in the discovery of insulin, a treatment of diabetes. He has lately been conducting muscle experiments on Olympic Games contestants. Muscles in action, Dr. Best explains, vary widely as to the amount of friction they set up. Whether this is because some muscle fibers move over each other more easily than others as though they were better lubricated, or because muscles differ in their attachments to each other, is not known. Muscle efficiency also depends on the body's supply of blood sugar. The muscle cells burn this to get energy. In a long race, the body's sugar reserve may become exhausted, with a resulting collapse. Dr. Best told of three cases of such collapse in the Olympic Games.

"HUMAN BEING" EXHIBIT BURNS IN GERMANY

A PRICELESS exhibit of all the physical and chemical parts that go to make a man was burned recently in Dortmund, Germany. Called the "Human Being," the exhibit included 2,000 original models of

the anatomical parts of the body, together with chemical compounds found in the body. Forty years of work by Professor Emil Hammer of Munich University had gone into the completion of the exhibit, which had been endorsed highly by medical authorities. The fire consumed the collection in a single hour, devouring all the wax figures and alcohol preparations. The money loss amounted to $150,000, but the loss to science cannot be repaired. The exhibit had lately been sold in the United States, where it was soon to have been shipped to be put on display.

NEW MOTOR MUFFLER ABSORBS THE SOUND

PRACTICALLY complete freedom from back pressure and the consequent loss of power are important claims made for a new "straight through" type of muffler. Exhaust gas flows freely through its tube. In place of "baffles" or restricting chambers, on which ordinary mufflers depend for reduction of exhaust noises, the new muffler has a lining of heat-resistant material which absorbs sound as do the porous curtains hung on theater walls.. The straight, perforated sheet metal tube is wrapped either in steel wool or a special muffling material. Around this there is, as a final covering, a metal cylinder. This makes up the muffler, which is open from end to end. This "straight through" principle is said to be applicable to other fields.

Special exhaust tests for loudness, back pressure, effect on horsepower, and endurance (ability to stand vibration and heat) were carried out in the factory. The instrument for testing loudness, a supersensitive meter for recording delicate sound waves, was of the same type as the one recently used by the Noise Commission newly appointed in New York City for measuring the street noises of different districts (P.S.M., Mar. '30, p. 51).

WALL OF WATER TO GUARD VAULT IN NEW BANK

REMINISCENT of the moats around medieval castles, walls of water will encircle the three-story vault that will occupy almost an entire block underneath the new Irving Trust Company Building, now under construction in Wall Street, New York City. Resting on solid rock foundations, the bottom of the vault will be sixty-nine feet under the street, well below sea level.

When the building is finished and the vault sides flooded, the bank's employees will be able to enter the subterranean treasure house only by means of air locks and pumps such as those used by tunnel workers under rivers. As for burglars or other intruders, they could not penetrate it unless they had submarine equipment.

A forty-foot "water-wall" is one of the features of an elaborate system of safeguards that protects the gold vaults of the Bank of France, in Paris, which cover two and a half acres 200 feet beneath the street. Fifty feet of rock also separate the outside world from the $1,000,000,000 stored there (P.S.M., Apr. '29, p. 68).

Above, the "straight through" muffler split down the middle. The sound absorbent material can be seen between inner perforated tube and outer steel jacket. At left, photo shows muffler is open from end to end.

VITAMIN G MAY PROVE CURE FOR PELLAGRA

PELLAGRA, a chronic skin disease prevalent in the southwestern part of the United States, may be wiped out by vitamin G, science's latest dietary discovery. Research along this line is now being made in Federal laboratories and in the universities, according to the American Chemical Society of New York City.

At the same time, announcement comes from the Georgia State Sanitarium that canned salmon is a pellagra preventive. This naturally raises the question: Does canned salmon contain vitamin G? At any rate sensational results following its use are claimed by Georgia experimenters. Pellagra is characterized by the recurrence of its symptoms every spring, the attacks increasing in severity. The patient loses weight and his skin hardens and develops black spots.

At the Georgia sanitarium eighteen pellagra patients were put on the salmon diet for one year. During that time none of them suffered a recurrence of the disease; though ordinarily, it is said, forty to fifty percent would have shown distinct symptoms.

Vitamin G, which it is expected will prove effective in combating this disease, is found in beef liver, kidney, heart, and muscle. Animals that were fed no fresh meat, eggs, or milk developed pellagra.

NEW ANESTHETIC LESSENS PAIN AFTER OPERATION

A NEW anesthetic has been produced in the laboratories of Prof. Richard Willstaetter and Dr. Carl Duisberg, well-known German chemists. Called "avertin" for short, it has the weighty chemical name of "tribromethyl alcohol," and comes in white crystals which are injected internally after being dissolved in the proper liquid medium. Physicians who have experimented with the anesthetic say that it will by no means displace ether, but is rather to be used in selected instances, as in abdominal operations.

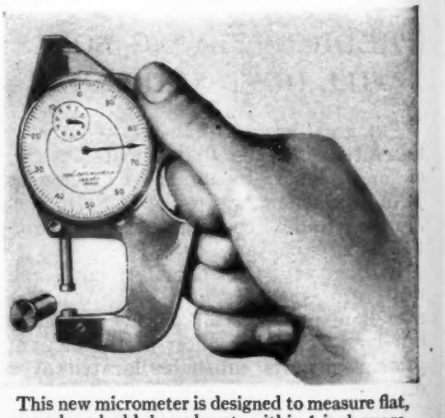
STEEL SHOES INVENTED FOR GERMAN PRISONERS

CUMBERSOME steel shoes designed with ball shaped soles so that the wearer must pay close attention to his balance in order to walk recently were invented by two Berlin detectives. They are meant to take the place of handcuffs now used on prisoners throughout the police world. The shoes, really heavy metal boxes, are lined with felt to prevent possible injury to the feet. The inventors claim that the criminal wearing them cannot run or make any sort of rapid headway without losing his balance and falling. The shoes are clasped to the feet and locked in place.

POCKET GAGE MEASURES THOUSANDTH OF AN INCH

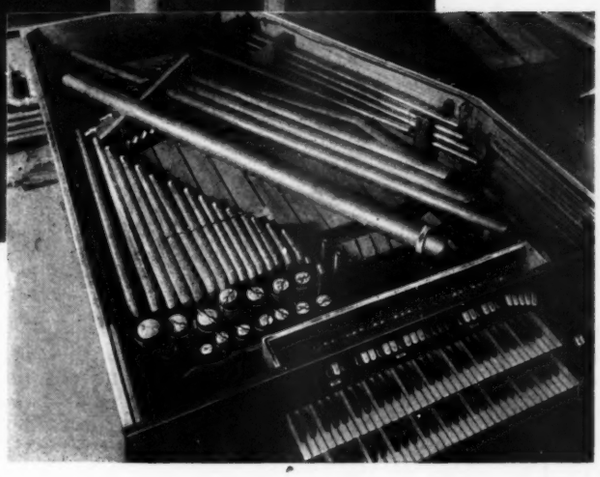
A NOVEL instrument which combines the ordinary micrometer and the familiar dial indicator gage has recently been invented. It is ideal for measuring small machine parts, sheet metal, wire, paper, rubber, or textiles.

A hardened steel pin, moving up and down within the measuring jaw of the device, transfers the measurement reading to a dial graduated in thousandths of an inch. Thus the advantages of a dial indicator are added to micrometer measurements. The instrument will take readings up to one inch. The spindle is lifted by a thumb attachment and may be locked, thereby holding the setting for use as a snap gage. This tool saves time because it is so easily read and eliminates the necessity for fine manual adjustment.



This new micrometer is designed to measure flat, round, and odd shaped parts within 1-inch range.

PIANO SIZE PIPE ORGAN FOR HOMES



This baby pipe organ that looks like a piano is designed for private dwellings. At right, some of the 231 hidden pipes that give the tone of a big instrument.

ONLY its double keyboard, a row of stops above it, and an inconspicuous pipe at the rear reveal that the latest musical instrument for the home is an organ. In size and form it looks like a piano. But within the case are concealed 231 pipes that, it is claimed, equal in richness and variety of tone the effects produced by pipe organs of great size. The "baby" organ is designed especially for dwellings of moderate size. An average-sized living room offers adequate space for it.

The makers discovered that the tone of a sixteen-foot pipe can be duplicated by one only eight feet long by fitting a smaller pipe telescoped within it. By making a continuous air passage through the small pipe and then back through its outer shell, an effective length of sixteen feet is obtained. Thus the same tones produced by a large concert organ are obtained from this portable instrument.

MACHINE GUN NAILER CARRIES 150 "SHOTS"

A "MACHINE GUN" nailer for fastening hardwood floors has been produced by a California inventor. A slotted tubing magazine holds 150 nails, which are fed by gravity, one at a time, into the "barrel" of the device and are driven and set by a blow struck on top of the plunger that operates in the barrel.

The invention is designed for use on less expensive hardwood boards that are not heavy enough to allow them to be made with tongue and groove edges for "blind" nailing, but which have to be nailed straight down through the surface.

In operating the mechanism, the carpenter lays the boards on the entire floor, then rules straight lines across them at right angles to the way they are laid. These lines, six inches apart, extend the length of the floor. Then the operator of the nailer, seated upon a low castered platform, moves along these lines setting a nail in the center of each board with a single blow.

A floor can be nailed in this manner, the maker declares, in less than a third the time usually required. By using a funnel and a piece of slotted tubing, the nailer magazine can be refilled, it is said, in less than a minute.

With 150 nails in its magazine, each of which is driven home with a blow on the plunger, this machine is said to save much time.

PREDICTS BETTER BRAINS FOR MAN—BUT WHEN?

A STEAM locomotive is only ten percent efficient. The average human brain, according to many psychologists, is even less efficient. Recently Dr. Ales Hrdlicka, anthropologist of the Smithsonian Institution in Washington, D. C., said that evolution will produce brains a hundred times more effective than those men now have. When the mechanism of the human body is altered so the millions of tiny cells that form the cortex of the brain receive a larger supply of rich, pure blood, Dr. Hrdlicka says, the power of the brain for sustained thinking will increase many fold.

After fifteen or eighteen hours of work, the poisons of waste matters, like "clinkers and ashes," clog up the brain and impair its effectiveness. Sleep is necessary to allow the blood stream to wash away the impurities and bring fresh food. When evolution produces men whose brains receive a more abundant blood supply, Dr. Hrdlicka maintains they will be able to concentrate for longer periods and will require less sleep to remain alert.

JERICHO'S TOWER FOUND AFTER 4,000 YEARS

SIR CHARLES MARSTON'S expedition to Jericho, the Canaanite city in the Jordan Valley, excavated an ancient tower which, it is believed, dates from the middle Bronze Age, about 2000 B.C. The citadel was unearthed by John Garstang, formerly director of the Department of Antiquities in Palestine and now in charge of the Marston expedition. He reports that it resembles the defensive tower depicted in Egyptian representations of Canaanite cities. The walls of the tower, well-preserved, rise twenty-seven feet above the foundations. Clues to its history may be found among relics of houses built against its side.

TELESCOPIC AUTO TRAILER IS HOTEL ON WHEELS

AN "ACCORDION auto trailer," which closes to the width of an ordinary automobile for road travel and can be expanded to the width of a railroad train to form a four-berth "Pullman" for night accommodations during long trips, recently has been put upon the market. The boxlike body of the trailer is split down the middle. When it is opened out, the roof is elevated to seven and a half feet and the two halves of the vehicle pulled out from the sides like dresser drawers until the interior of the trailer is approximately three times its original size. Waterproof flaps are buttoned across the gaps between the roof and the sides so that the interior is protected during inclement weather. The length of the vehicle is ten and a half feet.

The unusual coach is described as being a little "hotel on wheels." It contains four berths, a refrigerator, cupboards for food, drawers for clothing, two tables, night curtains to divide the interior into rooms, electric lighting, and bathroom facilities. Tests have shown, it is reported, that the trailer reduces the speed of the towing car only four miles an hour over good roads, as it is equipped with balloon tires and a special coupling device that is designed to take up all shocks between the vehicles.

By night the split coach contains berths for four people and provides for every comfort.

Telescoped together, when being towed, this new trailer is the width of a car; it couples to the auto with device designed to take up road shocks.

NEW WONDERS FOUND IN WORLD'S BIGGEST CAVE

NEW wonders of the largest underground cave yet found, the Carlsbad Caverns in New Mexico, were discovered by a recent expedition. Headed by Frank Ernest Nicholson, author and traveler, the party of a dozen explorers and scientists spent several weeks underground among the dazzling stalactites and crystals that abound there. The scene of their explorations has been a national park since 1923.

Descent by ropes into what long was known as the "Bottomless Pit" showed it to be a black abyss 300 feet deep, with a dry river bed at its base. Elsewhere the explorers descended 1,350 feet underground, the cave's lowest level, and thus determined it to be the deepest natural cavern yet explored.

Wearing special helmets to protect them against falling pieces of stalactites, or icicle-shaped fragments of water-deposited rock, the explorers added at least ten miles of new underground passages to the twenty-two miles that already were well known. A short-wave radio set operated by Eric Palmer, Jr., youthful radio enthusiast whose preference for radio to his studies once incurred a suspension of his license by the Federal Radio Commission (P. S. M., Mar. '28, p. 39), kept the explorers at all times in touch with the world.

A captive balloon was the most novel piece of equipment of which they made use. They had planned to make an underground ascension in one of the most famous of the caverns 750 feet below ground, a room "big enough to hold three or four skyscrapers." An observer on top of the balloon could then study the formation of the roof. It was not reported, however, that the ascension was made.

GERMS SURPASS MAN AT MAKING COCONUT OIL

Germs may prove of great importance to industry in the future. A recent report to the American Chemical Society from J. W. Beckman, of Oakland, Calif., states that the microbe *Bacillus delbrueckia* can make coconut oil less expensively and more efficiently than man-directed processes now used. The bacillus, it is claimed, can bore into the heart of the coconut substance and unlock the millions of little oil globules from their cells.

Coconut oil is obtained from copra, the dried pulp of the nut which is obtained in great quantities from the South Sea Islands. To produce the oil, copra is heated or treated to make the walls of the oil cells brittle. Then the oil is squeezed out in powerful presses. But this process is expensive and unsatisfactory.

The *delbrueckia* germs, it is said, can eat away the cell walls of untreated coconut pulp, set free the oil, and convert the wall substance into chemicals like those of meat. The pulp that remains is said to be good for cattle food.

TEAR GAS GUN SHOOTS CHEMICAL 150 YARDS

A TEAR gas gun that shoots the blinding chemical 150 yards has been adopted for use by the police department of Chicago, Illinois. The chemical, which causes temporary loss of sight, is in a shell which is fired when a trigger is pressed.

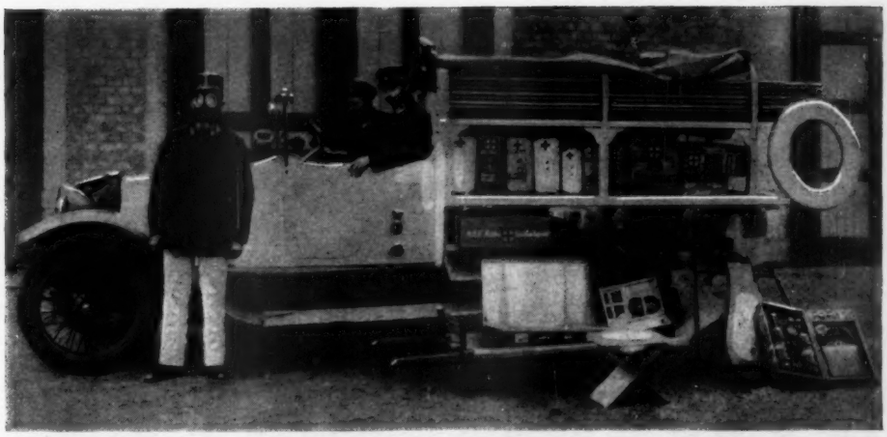
It is expected that the long range of the device will enable law officers to drive criminals from their hiding places when they have barricaded themselves in and are repelling attacks with gunfire. The gun is said to weigh no more, and to be no longer, than an ordinary riot gun.

John Egan, Deputy Chief of Detectives of Chicago, inspects the long range tear gas gun.

EUROPE GETS ITS FIRST ACCIDENT AMBULANCE

A MILE-A-MINUTE "wreck ambulance," equipped to meet practically any large scale emergency, has been put into use by the city of Baden, near Vienna, Austria. This is the first time service of this kind has been established in Europe. A second machine of the same type will be equipped for similar work. Each relief machine will carry enough bandages, antiseptics, surgical instruments, and other first aid supplies to treat nearly fifty patients. Gas masks, ready to afford workers protection against all kinds of poison gases, are part of the equipment.

Six stretchers and a tent enable an emergency hospital to be erected at the scene of disaster. An attachment will bring about a quart of water to boiling point in five minutes for disinfecting purposes. The machines are expected to save many lives through prompt aid in railroad wrecks, fires, and similar disasters.



Put in service by Baden, Austria, this accident ambulance is equipped to give first aid to 40 or 50 injured persons. Among other things it carries gas masks, one of which is here worn by an attendant.

SYNTHETIC CATNIP OIL USED TO BAIT LIONS

A SYNTHETIC catnip oil is the latest aid in capturing man-eating lions. According to reports, the oil is used successfully to bait traps for "all of the big cats, from lion to bobcat." The liking for catnip which lions share with domestic tabbies is a striking proof of their kinship to the rest of the cat family. This links them with tigers, leopards, pumas, and jaguars.

NEW GERMAN FIRE ENGINE RUNS ACROSS FIELDS

DASHING across plowed fields, over railroad tracks, and through shallow streams, a speedy new "overland fire engine," recently constructed in Berlin, Germany, will take short cuts in reaching rural fires. The feature of this fire-fighting equipment is the unusual chassis which allows the machine to maintain a relatively level balance while the wheels twist in meeting hummocks and depressions in running across country fields.

This chassis, with its six wheels, is said to have been suggested by the design of the early French tanks which were used in the Sahara Desert during the World War. In reaching a fire, the ability of the machine to make runs across fields, instead of having to follow roundabout roads, is expected to result in saving buildings, which, under ordinary conditions, might be consumed before the fire-fighters arrived.

MONTANA RIVER RUNS AWAY FROM BRIDGES

NOT SATISFIED with leaving two perfectly good bridges high and dry, with nothing to bridge, the temperamental Powder River of Montana is wandering again. This time it has sliced off a large chunk of the Moorhead highway, near Broadus, Mont., necessitating a lengthy detour.

Last summer the queer river gave notice of its intention to abandon the latest of its many different courses. At that time the strenuous efforts of farmers were all that prevented it from leaving a third steel bridge on dry land.

SKYSCRAPER TO COMBINE OFFICES AND GARAGE

ONE of the first skyscrapers that will cause traffic officials no concern is the proposed twenty-eight-story Sutter Building, in San Francisco. It will be a skyscraper without a parking problem, because the first eight floors are to used as garages for the tenant's cars. Offices will fill the remaining twenty floors, in the plans which have just been made public.

Thus there is no need of parking on a congested city street. A tenant arriving by car drives up a ramp, parks on one of the eight floors, steps to an elevator, and is whisked to his office.

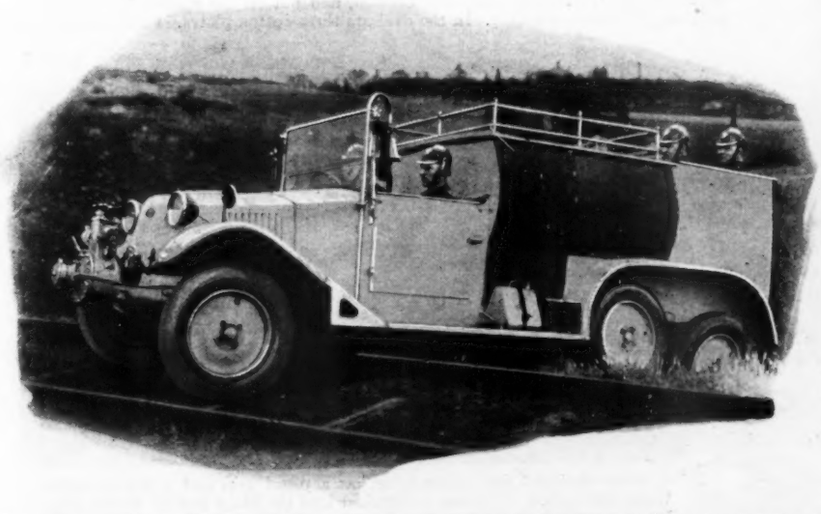
The combined skyscraper and garage is an outgrowth of the multi-storied garage idea, notably illustrated in the "automatic parking" garages that have made their appearance in several cities (P.S.M., Dec. '28, p. 69; Oct. '29, p. 70). The present trend is to make the same building serve as office and garage. One such building already is under construction in Philadelphia, and a twelve-story, 1,000-car garage in Detroit may be made part of a proposed eighty-five-story skyscraper to be built around it.

AMERICAN DESERT YIELDS CARBON DIOXIDE GAS

SEARCHING with drill and derrick for carbon dioxide gas, which is the "fizz" in all manufactured sparkling drinks, and the gas from which "dry ice" is made, may soon be a familiar sight on the Great American Desert.

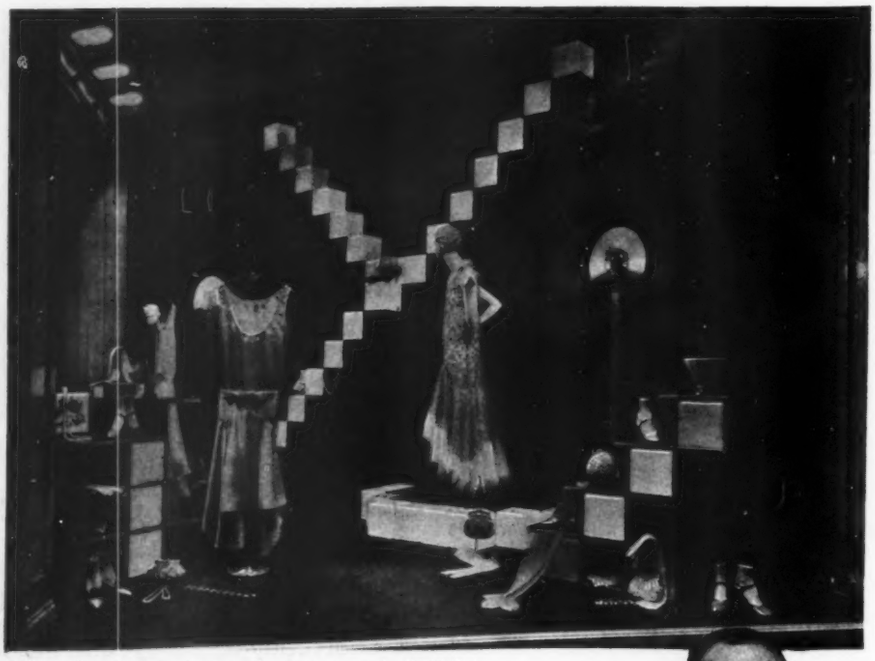
The United States Department of the Interior reports that several wells recently drilled in search of oil and natural gas, in the desert regions of western Colorado and eastern Utah, have surprised the prospectors by gushing forth streams of carbon dioxide gas instead. This gas is as suitable for manufacturing refrigerant as is artificial carbon dioxide, produced by burning coke and capturing the fumes.

Anticipating a rush of prospectors for the new gas, the Department of the Interior announces a plan by which they may develop commercially any carbon dioxide wells they find on Government land through the payment of a nominal royalty of two cents per thousand feet of ga-



This fire engine, built in Berlin, Germany, is designed for use in rural districts. Its chassis is built to maintain a balance while the wheels twist in running over obstacles. It is seen here crossing a railroad.

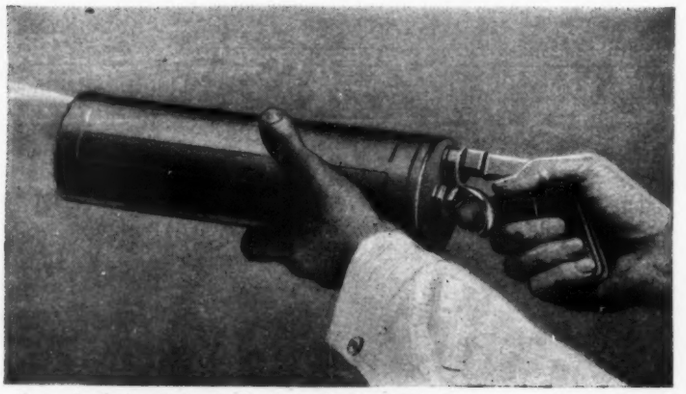
Novel Products of Inventors



Cubes of heavy translucent glass, that can be built into various attractive designs, are the latest novelty in lighting. Lamps within the cubes throw a highly diffused illumination with, it is claimed, no shadows at the corners. These blocks may be arranged either for artistic or practical purposes in the home or place of business and are so strong that they can be used as steps. Originally they were intended for advertising purposes, but they are now becoming extremely popular for private residences. Bulbs of different colors can be put in them and an unusual effect is thus secured. The cubes range in size from four to twelve inches. The photo shows the blocks lighting a shop window.

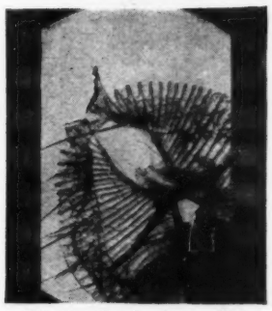
These articles may look like china and wood, but they are made of cotton by a process developed by J. Samuels, seated, of London, and put on the market by him and his co-patentee, H. Wass, standing. In the oval are three cotton plates. Furniture also is made.

The shoes worn by the smaller man, above, are designed to prevent smashed toes. The tip of each is heavily reenforced with a stiff and strong material. They are meant to be worn by factory workers and others who are in danger of injury to the feet through the dropping of heavy objects upon them. Their manufacturer claims that a falling steel bar or the passing of a truck wheel will not hurt the foot protected by them. In the picture the wearer of the shoes is supporting, without discomfort, a man weighing about 185 pounds.

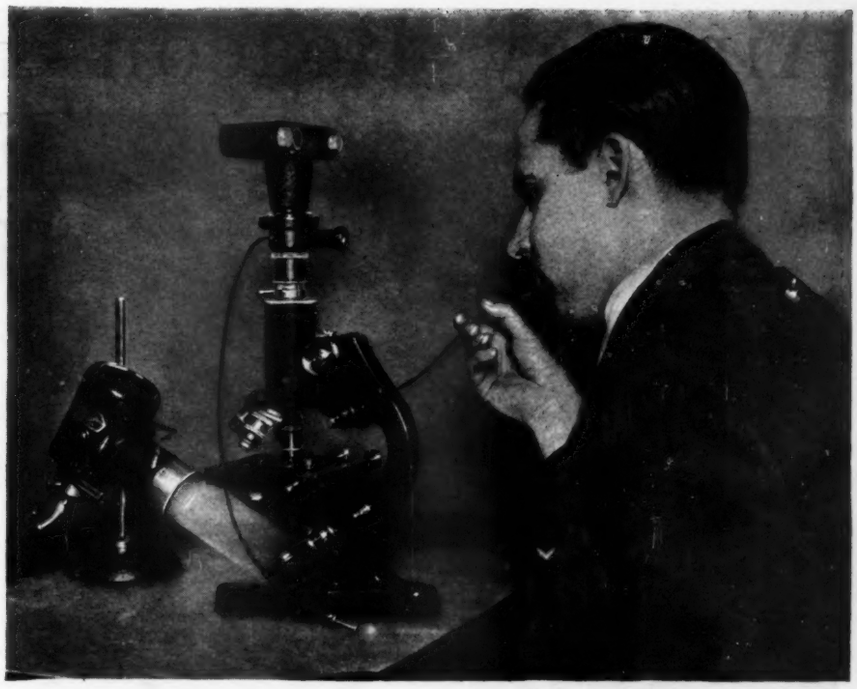


A newly designed fire extinguisher has a pistol grip and a trigger release. When discharged, it throws a chemical into the blaze exactly where aimed. Rough handling, it is claimed, will not set it off unless the trigger is pulled. A safety seal shows whether the extinguisher has been fired or tampered with.

Mechanical Devices to Help Speed Up World's Tasks



The trunk of a house fly, enlarged about forty times, taken on movie film with camera and microscope.

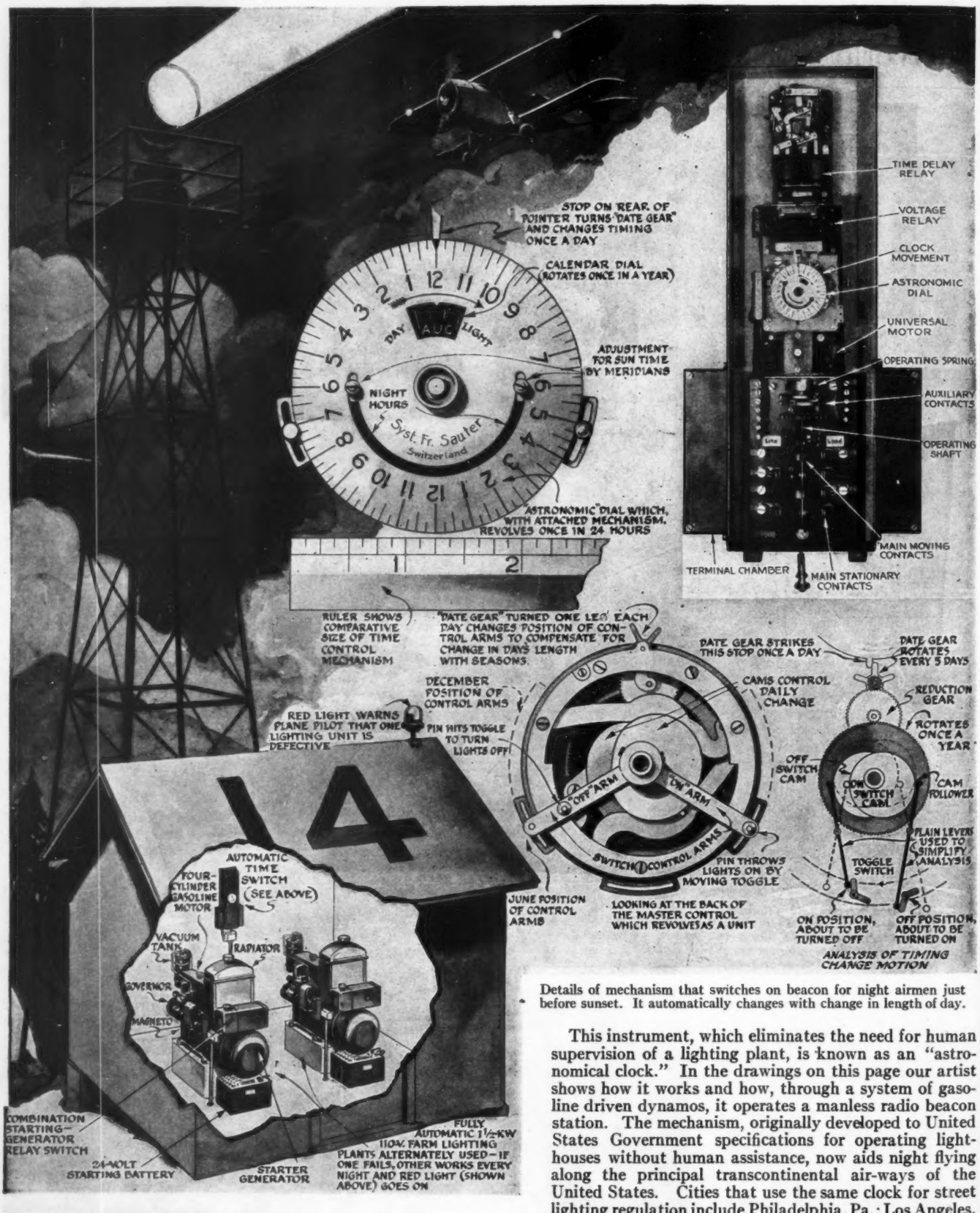


Pictures of microscopic enlargements can now be made on motion picture film. This new camera which makes this possible and which has a capacity of thirty-six exposures without reloading can be attached to any standard microscope. The photographs are made instantaneously or by time exposure. The illustration shows the camera attached to a microscope, with the operator ready to click the shutter. An eyepiece at the side permits a view of the specimen during the exposure. If maximum light is desired, as in taking snapshots, this prism can be swung aside. The camera is loaded in daylight, and film for an entire illustrated lecture, it is claimed, is so small that it can be carried in the vest pocket.

Life-sized pictures of criminals wanted by the police are now shown on a screen about four feet square to both the uniformed men and detectives of Los Angeles, Calif. A film projection apparatus is used and it is believed that these close-up studies will be of great aid in the apprehension of lawbreakers. The photo shows Ray H. Pinker, research chemist of the Los Angeles police department, operating the projector.

In the neighborhood of Chicago houses are being built in sections. A solid floor, generally of concrete, is laid and upon this the walls are cast. As a wall is finished, derricks grapple it and hoist it into place after which its lower edge is permanently tied to the foundation. The photo shows a bungalow wall being raised by derricks. These walls are made of insulation board, cinder concrete, and cement mortar, with criss-cross of metal bars. The advantages claimed for this construction are the saving of labor and a wall that resists cold.

Air-Way Beacon Runs Itself


TIME DELAY RELAY
VOLTAGE RELAY
CLOCK MOVEMENT
ASTRONOMIC DIAL
UNIVERSAL MOTOR
OPERATING SPRING
AUXILIARY CONTACTS
OPERATING SHAFT
MAIN MOVING CONTACTS
TERMINAL CHAMBER
MAIN STATIONARY CONTACTS
STOP ON REAR OF POINTER TURNS "DATE GEAR" AND CHANGES TIMING ONCE A DAY
CALENDAR DIAL (ROTATES ONCE IN A YEAR)
DAY
AUG
LIGHT
NIGHT HOURS
ADJUSTMENT FOR SUN TIME BY MERIDIANS
Syst. Fr. Sauter
Switzerland
"ASTRONOMIC" DIAL WHICH, WITH ATTACHED MECHANISM, REVOLVES ONCE IN 24 HOURS
RULER SHOWS COMPARATIVE SIZE OF TIME CONTROL MECHANISM
"DATE GEAR" TURNED ONE LEG EACH DAY CHANGES POSITION OF CONTROL ARMS TO COMPENSATE FOR CHANGE IN DAYS LENGTH WITH SEASONS
DECEMBER POSITION OF CONTROL ARMS
RED LIGHT WARNS PLANE PILOT THAT ONE LIGHTING UNIT IS DEFECTIVE
PIN HITS TOGGLE TO TURN LIGHTS OFF
DATE GEAR STRIKES THIS STOP ONCE A DAY
DATE GEAR ROTATES EVERY 5 DAYS
CAMS CONTROL DAILY CHANGE
REDUCTION GEAR
ROTATES ONCE A YEAR
OFF SWITCH CAM
ON SWITCH CAM
CAM FOLLOWER
"OFF" ARM
"ON" ARM
SWITCH CONTROL ARMS
PIN THROWS LIGHTS ON BY MOVING TOGGLE
PLAIN LEVERS USED TO SIMPLIFY ANALYSIS
TOGGLE SWITCH
JUNE POSITION OF CONTROL ARMS
LOOKING AT THE BACK OF THE MASTER CONTROL WHICH REVOLVES AS A UNIT
ON POSITION, ABOUT TO BE TURNED OFF
OFF POSITION, ABOUT TO BE TURNED ON
ANALYSIS OF TIMING CHANGE MOTION
AUTOMATIC TIME SWITCH (SEE ABOVE)
FOUR-CYLINDER GASOLINE MOTOR
VACUUM TANK
RADIATOR
GOVERNOR
MAGNETO
COMBINATION STARTING-GENERATOR RELAY SWITCH
24-VOLT STARTING BATTERY
STARTER GENERATOR
FULLY AUTOMATIC 1½-KW 110-V. FARM LIGHTING PLANTS ALTERNATELY USED—IF ONE FAILS, OTHER WORKS EVERY NIGHT AND RED LIGHT (SHOWN ABOVE) GOES ON

Details of mechanism that switches on beacon for night airmen just before sunset. It automatically changes with change in length of day.

A DISK no bigger than the palm of the hand, and less than an inch thick, houses a "mechanical brain" that turns isolated lighthouse or air-way beacons on and off to correspond exactly with the daily change in the rising and setting of the sun. An additional service of the versatile device is automatically to turn on a city's street lights at sunset and switch them off at dawn.

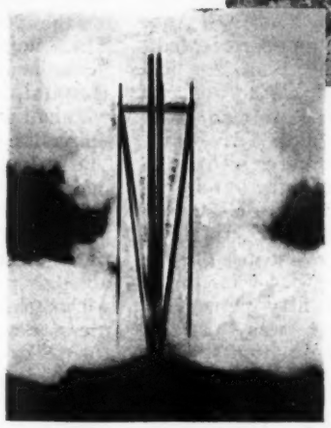
This instrument, which eliminates the need for human supervision of a lighting plant, is known as an "astronomical clock." In the drawings on this page our artist shows how it works and how, through a system of gasoline driven dynamos, it operates a manless radio beacon station. The mechanism, originally developed to United States Government specifications for operating lighthouses without human assistance, now aids night flying along the principal transcontinental air-ways of the United States. Cities that use the same clock for street lighting regulation include Philadelphia, Pa.; Los Angeles, Calif.; Baltimore, Md.; Rochester, N. Y.; Minneapolis, Minn.; Cleveland, Ohio; Milwaukee, Wis.; Columbus, Ohio; and other important centers.

As darkness may come at 5:30 in December but as late as 8:30 in June, the clock must be adjusted to the daily changes in the number of daylight hours so as to turn on the lights fifteen minutes before sunset and switch them off fifteen

minutes after sunrise. Of the two ways of doing this—by purely mechanical adjustments or by a photo-electric "eye" that responds to changes in illumination—this clock uses the mechanical method, outwardly the more difficult. But so skillfully fashioned are two revolving cams that daily reset the clock that it automatically follows "sun time" more accurately than if reset by hand.

The face of the twenty-four-hour clock dial, and the entire cam and gear mechanism attached to it, revolve as a unit. Two control arms behind the dial are fitted with projecting pins. As the mechanism rotates, the pins engage, in turn, a small L-shaped toggle that trips the main electric switch. One control pin turns this switch on; the other, off. By changing position of the arms on which the pins are mounted, the daily change in "on" and "off" timing is made.

Each time the mechanism revolves, a "star wheel" passes a stationary pin which revolves it one fifth of a turn. This motion, geared down, turns the cams exactly 1/365th of a complete revolution and moves the switch-operating pins to a new position. Thus the switch mechanically predicts the coming of sunrise and sunset.



Photograph taken at the instant the mail rocket was shot into space.

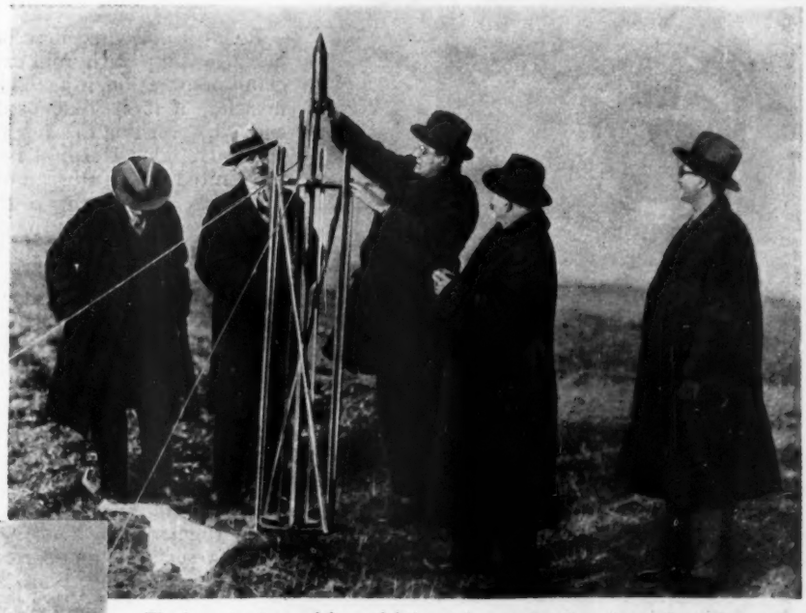
THE illustration shows this "mechanical brain" applied to the regulation of an automatic air-way beacon. In a small building beside a beacon mast, two complete gasoline-driven farm lighting plants are housed. On the wall is a box containing the clock with its diminutive dial. The place has no human occupants; as the time of sunset approaches, there is no sound save the faint ticking of the clock.

Suddenly a snap comes from the clock. An electric switch inside its box closes. A self-starter on gasoline motor number one whirs. The motor fires and spins the dynamo. Motor and dynamo run steadily for more than a third of a minute—then another snap and the beacon, atop the mast, lights up. There is no chance of stalling the motor when the beacon is first turned on, for a time-delay system automatically withholds cutting in the added load of the beacon until the motor has been warmed up by running for twenty-five seconds.

Should the motor fail to start, another automatic device at once transfers the duty of supplying current to motor number two, which is standing by. The good motor continues to supply the current until the fault is repaired. At the same time a red light on the roof of the beacon house lights, warning passing pilots that one motor is defective. In normal operation the motors are used on alternate nights.

POPULAR SCIENCE MONTHLY is always pleased to answer questions on any subject within its field, if readers will address their inquiries to the Information Department, 381 Fourth Avenue, New York, inclosing a stamped, self-addressed envelope for reply.

ROCKET AS MAIL-CARRIER PASSES TEST



The inventor (second from right) watches preparations for mail rocket test.

AIR MAIL minus plane and pilot was dispatched at Prague, Czechoslovakia, the other day. The occasion was the first test of a mail-carrying rocket designed by L. Ocenasek, a Bohemian inventor. He erected a stand, placed a small model rocket upon it, and fired the projectile into the atmosphere. He had previously calculated the spot at which it would land, and to his delight it unerringly arrived at that point after rising 3,000 feet in the air. The test showed, he declared, that larger rockets might carry mail with bulletlike precision between distant points.

Other inventors, notably Prof. Herman Oberth, Austro-German inventor, have experimented with rockets as possible mail carriers (P. S. M., Feb. '30, p. 41).

ENGLAND GETS HELIUM FROM MONAZITE SAND

AMERICANS take helium from natural-gas wells, but the British would extract it from sand. This nonexplosive gas for airships, according to R. Taylor, of the Chemical Research Laboratory at Teddington, England, can be obtained from "monazite sand," hitherto valued chiefly as a source of material for the manufacture of gas mantles.

Although the process is somewhat expensive, it may prove practical since Britain has no such extensive natural sources of helium as those of Texas and other regions in the United States. The gas, extracted from the sand by heating, is treated with heated magnesium metal and hot calcium which removes nitrogen and other impurities.

DO ACTIVE VOLCANOES EXIST IN AMERICA?

"EXTINCT" volcanoes have a kick left in them, according to the American volcano expert, Dr. T. A. Jaggar, who projects a volcano observatory in this country. He claims it is a mistake to suppose that there are no active volcanoes in continental United States.

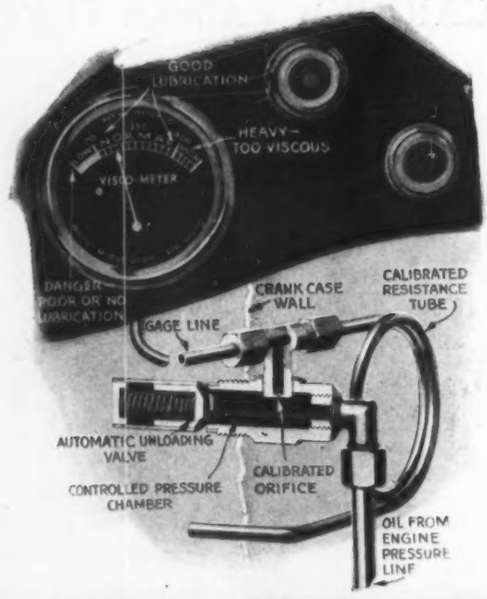
There is good reason to believe, Dr. Jaggar says, that Mount Shasta, in northern California, is still an active volcano; and that Mount Saint Helens in southern Washington and Mount Baker in the northern part of the state could put on a show at any time.

Another peak of this northwest region, Mount Lassen in a sparsely-settled section of northern California, actually did erupt in 1915, Dr. Jaggar points out, though with no discharge of lava and no loss of life.

RADIO TRANSMITTERS ARE PERIL TO BATTLESHIPS

A NEW HAZARD has been discovered aboard Navy battleships and aircraft in the powerful short-wave radio transmitters which they carry. Investigations of the Navy Department's Bureau of Engineering revealed that stray electric currents of a high frequency nature, induced in metal fittings by the radio transmitter, constituted a peril when they were near stores of explosives.

In one test it was found possible to light a twenty-four-volt lamp by connecting it between the breech of a turret gun and the turret; and to explode the primer in the breech by this current. As a result of the tests, Admiral Charles P. Hughes, Chief of Naval Operations, banned radio transmission at frequencies greater than 4,000 kilocycles during target practice or when refueling.



NEW METER SHOWS WHEN TO CHANGE MOTOR OIL

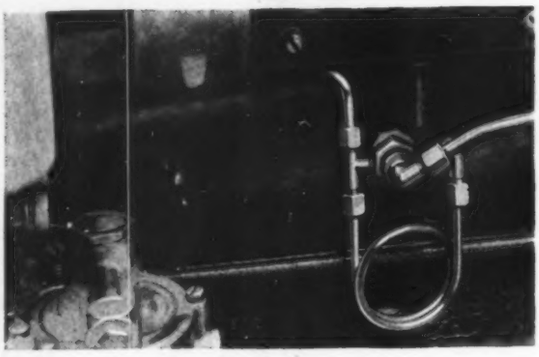
INSTEAD of changing the oil in the crank case of your motor car every so often by guesswork, a meter recently invented and put on the market makes it possible for the motorist to keep a continuous check on the condition of the oil. He no longer needs to be in doubt as to the state of his motor lubrication, since the new meter tells him when the oil has become so diluted by unburned fuel that it is no longer fit for use and may have become a real menace to his engine. A meter on the instrument panel indicates the viscosity or thickness of the oil and shows when new lubricant is needed.

In the sectional view of this device which is shown above, the controlled pressure chamber is screwed into a hole drilled and tapped into the side of the crank case. Oil from the engine pressure line constantly is fed into this chamber, and the automatic unloading valve, by allowing excess oil to flow back into the crank case, maintains in the chamber a constant oil pressure.

The amount of oil that will flow through the tiny, calibrated orifice necessarily depends on the viscosity of the oil, and this viscosity or thickness also determines how easily the oil will flow through the calibrated resistance tube. The back pressure created by this resistance is read on the viscosity meter which is, of course, merely a sensitive pressure gage, calibrated to correspond to the thickness of motor oil at various stages of dilution.

PARATHYROID HELPS RADIUM VICTIMS

RADIUM poisoning may be cured hereafter by parathyroid extract, a gland preparation, injected into the muscles, if it is diagnosed early enough, according to a report of the Johns Hopkins Hospital issued by the United States Bureau of Labor Statistics. The horrors of "radium necrosis" are shown in the plight of the five girls who worked at watch and clock dial painting in an Orange, N. J., plant (P. S. M., July '29, p. 17). A peculiar green glow of the skin visible in the dark, general undernutrition, failure of wounds to heal, pallor, and the appearance of wasted areas on the skull are some of the symptoms of the disease.



The "parathyroid" treatment for radium poisoning was suggested by Dr. J. C. Aub, Associate Professor of Medicine at the Harvard Medical School, and his co-workers. Three young women, who worked with radioactive paint before 1925, were given direct injections of parathyroid extract into the muscles every other day for a period of seven weeks. By means of the electroscope it was found that about fifty percent of radioactivity was lost by each of the patients. The treatment also caused improvement in general condition and a gain in weight. The hospital authorities stated, however, that probably no permanent improvement could be expected for cases several years old.

FOLDING BEACH MAT HAS PARASOL TO MATCH

WHEN a seashore visitor tires of strolling along the beach, he may now make himself completely comfortable on the sand. A small bundle under his arm unrolls, is spread out, and in a jiffy it has become a soft mattress, even to a pillow, upon which to recline and take a sun bath. Should the sunshine grow too hot for comfort, a parasol of the same material shields the user from the sun's rays.

This novel aid to comfort was one of several beach accessories that were exhibited recently in London. Another one of them was an ingenious hand bag with compartments for bathing suit and towel, and even a special pocket in which a parasol may be carried.

This beach mat, with pillow attached, rolls up into a small bundle that can be carried under the arm, along with the parasol that matches it. They were shown at a recent exhibit in London, England.

NOISE CAUSES BIG RISE IN BRAIN PRESSURE

EXPLOSION of a paper bag near a person's ear raises his brain pressure, a phenomenon of brain fluid analagous to blood pressure, to four times its normal level. Such is the effect of sound on the nerves of the brain, according to Dr. Foster Kennedy, neurologist and member of the Noise Abatement Commission. These noise experiments were carried on in the neurology department of Bellevue Hospital, New York City. There, patients who had undergone an operation that required the removal of a piece of skull bone, the scalp having been replaced over the incision, were used as subjects for the noise tests. A small drum containing a partial vacuum was laid against the patient's scalp over the soft area, which acted as a sensitive index of the pressure within the skull. Any variations in this pressure were transferred to the drum and thence to a needle that recorded them. When a paper bag was burst near the patient's ear, it was found that this pressure increased four times.

Glass Walls Now Used in Building

By

ROBERT E. MARTIN

THE world's first skyscrapers of glass may rise, shortly, in New York City and in Chicago. Four of them, intended as apartment houses, are proposed for New York in 1931, and at least one for the midwestern city. They will have no windows, and they won't miss them. Their walls from the ground floor to the top will be of clear plate glass, hundreds of panes of it, held in place by a thin framework of copper. The weight of the building will be supported by a core of concrete hidden within the structure. This plan, proposed by Frank Lloyd Wright, noted Chicago architect, calls for the most extensive use yet made of glass as a building material.

Only within the last few months have architects realized that glass is a building material. Suddenly the "glass house," longstanding proverbial joke, has become reality. A huge public building in Magdeburg, Germany, has five-story-high walls of glass alternating with its sections of brick front. A department store has been built almost entirely of glass in the German city of Geisenkirchen. Even bricks of glass have appeared. Such bricks, manufactured in Holland and in Germany, are now being imported for use in America.

What makes "glass houses" sensible in 1930, when they would have been considered fantastic a few years ago, is the need for more light in city buildings. No one proposes that glass may replace steel and other materials to hold up a heavy building. Of course it is not strong enough. But every building has great outside walls of brick or stone known as "curtain walls." They hold up no weight. In fact, they themselves are completely supported by a concealed framework of steel girders. These are the walls which advanced architects now propose to build of light-admitting glass.

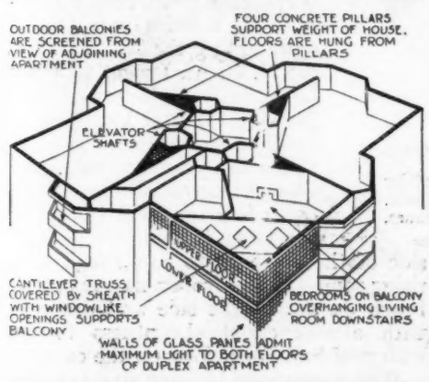
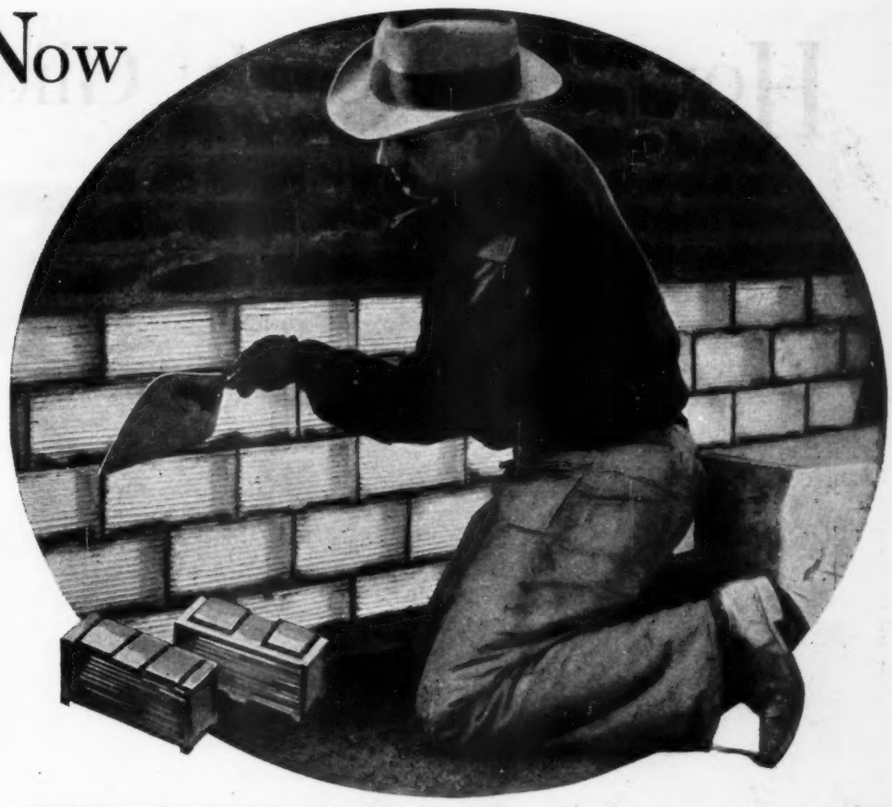

OUTDOOR BALCONIES ARE SCREENED FROM VIEW OF ADJOINING APARTMENT
FOUR CONCRETE PILLARS SUPPORT WEIGHT OF HOUSE. FLOORS ARE HUNG FROM PILLARS
ELEVATOR SHAFTS
CANTILEVER TRUSS COVERED BY SHEATH WITH WINDOWLIKE OPENINGS SUPPORTS BALCONY
BEDROOMS ON BALCONY OVERHANGING LIVING ROOM DOWNSTAIRS
WALLS OF GLASS PANES ADMIT MAXIMUM LIGHT TO BOTH FLOORS OF DUPLEX APARTMENT

Diagram of internal construction of proposed glass building designed by Frank Lloyd Wright.



Finishing a wall of glass bricks thirty-eight stories up, in the Barbizon Plaza, New York City. The photo shows the inside of the wall and illustrates its lighting effect.

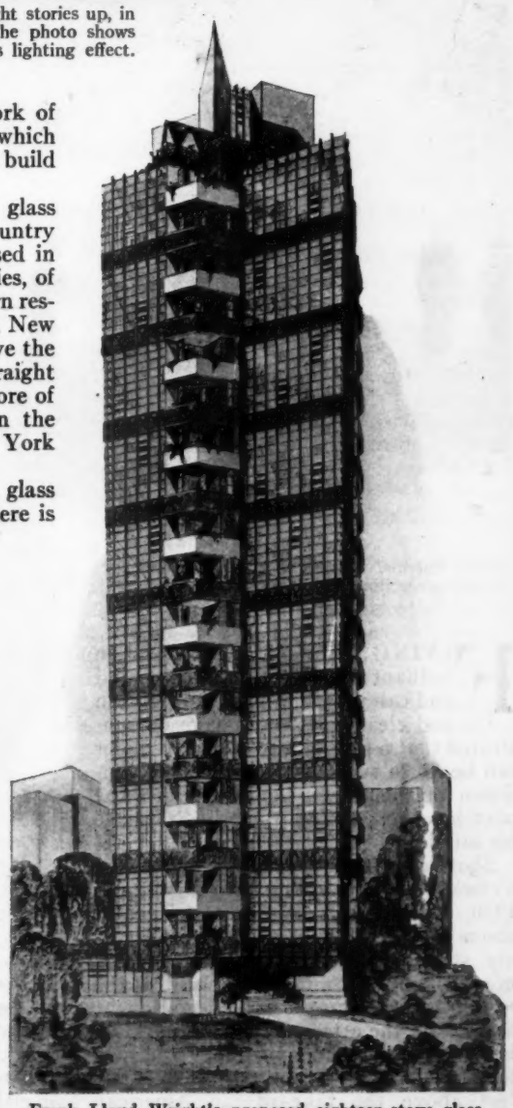
The first shipment of the new glass bricks recently arrived in this country from Holland. They have been used in part of the walls, on the upper stories, of the Barbizon Plaza—an ultra-modern residential hotel nearing completion in New York City. Thirty-eight floors above the street, they let outdoor light in straight through the walls of the rooms. More of the same bricks are to be used in the tower of the Town House, a New York apartment building.

How practical it is to live in a glass house is shown by these walls. There is no lack of privacy. A ribbed design on the surface of the bricks lets light through but makes it impossible to see through them. Thus the first requirement of walls of glass is met.

But there are others. A wall must not allow the warmth of a building to escape in winter. It must be reasonably tight against the clattering noises of the street, and proof against rain and moisture. It must be fireproof as well as substantial. These needs, it is claimed, are met by the glass bricks.

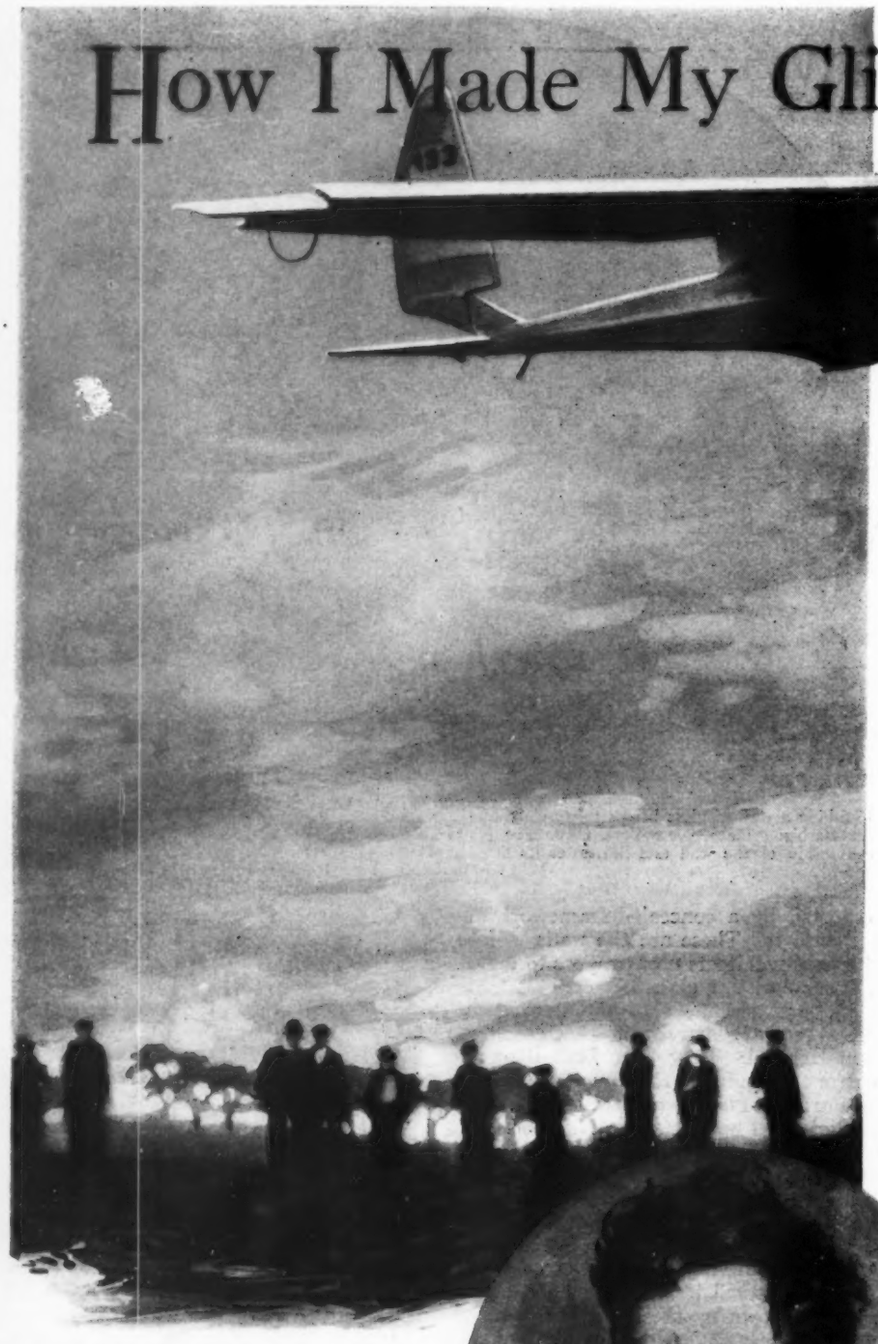
Although they are a little larger than bricks of clay, they are laid with mortar in exactly the same way. Interlocking ribs on their surface fit closely together, but allow one brick, if it ever breaks, to be slid out and replaced with another. Inside, the bricks are hollow. This

(*Continued on page 141*)



Frank Lloyd Wright's proposed eighteen-story glass apartment house. Note concrete core projecting at top.

How I Made My Glider Records



Three hundred persons were at Point Loma, Calif., to see Bowlus start his nine-hour flight.

By

W. HAWLEY BOWLUS

The author of this article is the holder of the American glider duration record of 9 hours, 5 minutes, 27.4 seconds, and of the American glider altitude record of 1,500 feet above point of take-off, both made in a sailplane of his own design and construction near San Diego.

FLYING in total darkness and in brilliant moonlight, in heavy wind and calm air, and in torrential rain and clear weather, I have demonstrated that a properly-constructed glider can be flown successfully under any condition of the atmosphere, provided the pilot has the training properly to handle his sailplane.

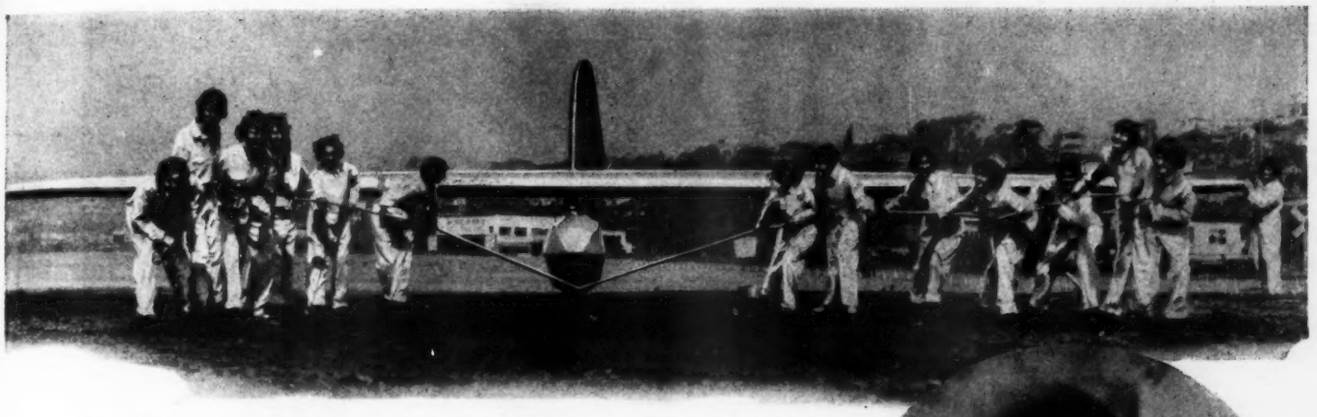
Shot from the earth shortly after one o'clock on the morning of January 12, 1930, I reached an altitude of 1,500 feet above sea level, or nearly 800 feet above my starting point. Launched from a near-by spot on Point Loma, Calif., at the Silver Gate entrance to San Diego Bay, at 5:37:03 on the afternoon of February 23, in the same sailplane, I reached and held for some time an altitude of nearly 1,500 feet above the take-off—an American glider record.

W. Hawley Bowlus, who holds the American glider record for continuous flight and also for altitude. Bowlus designs and constructs his own sailplanes.

On the first flight, I remained in the air six hours, nineteen minutes, and three seconds; on the second, I stayed up nine hours, five minutes, and twenty-seven and four-tenths seconds. The distance flown on either flight was not measured, but the average speed was approximately twenty miles per hour, and I believe that, on the second flight, considerably more than 150 miles was covered. The German endurance record of more than fourteen hours in the air, and the German point-to-point cross-country distance mark of ninety miles, do not seem so far in the future as they did before I learned what my two record-seeking flights have taught me.

While the second flight of a bit more than nine hours is the more important, the first was of great value because it taught me a number of new tricks in the art of flying sailplanes, and at least one new method of operation whereby altitude may be gained even when wind and other conditions are opposed. With *Old Number Eighteen*, a sailplane of sixty-foot wing spread and 165 pounds net weight, accompanied by Dr. W. H. K. Kumm, chief observer, and William van Dusen, representing the N. A. A. and the N. G. A., I went to Point Loma early in the evening of January 11, after Uncle Sam's weather watchmen at San Diego had promised me favorable gliding conditions. Point Loma is a southward-pointing peninsula, forming the western side of the entrance to San Diego Bay, rising some 750 feet from a narrow, rocky beach on the Pacific side and dropping with almost equal abruptness to the waters of San Diego Bay on the east.

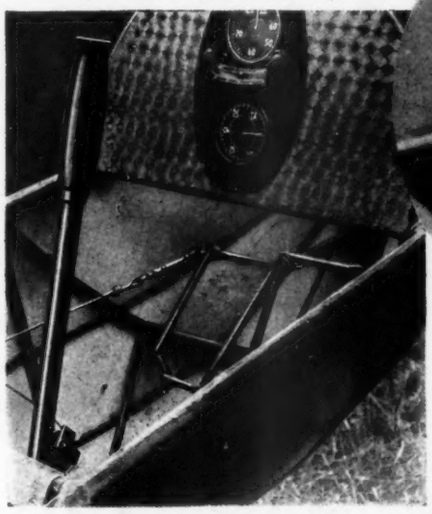
With a west wind blowing about twenty miles an hour, the sky cleared and bril-



Mrs. W. H. Bowlus in the cockpit of a sailplane. Members of the Anne Lindbergh Glider Club, San Diego, hold the shock cord ready to send her into the air.

liant moonlight showed a foam-covered sea pounding on the stones far below. It was a dangerous place for flight. If I fell into the sea, or onto the rocks, I would never fly again. But at 1:17:03.5 A.M. I took off. The cockpit, covered with water-tight canvas closed longitudinally with "zipper" fasteners so that I could release myself instantly, contained a sealed barograph, an altimeter, a clock, and four sandwiches. Nothing but my head and neck appeared above the cockpit covering, and the sailplane, completely loaded and with me in the cockpit, weighed 333 pounds. It was the same plane in which Colonel and Mrs. Charles Lindbergh had learned glider flying the week before.

I knew that it would be necessary to risk flying out over the sea to gain altitude, so that the air currents would bear me back, higher and higher at each return toward the land. The take-off into the west wind was comparatively easy. Moving toward the ocean, and then back, weaving across sea and land, I soon gained an altitude of 1,500 feet above sea level, where I sailed to and fro for two hours, flying north and south along the point and the coast, inland and out again, with comparatively smooth air and steady, though occasionally "jumpy," wind.



Gliders now have instruments. This one has altimeter and air speed and bank indicators similar to the ones used on motored planes.

Bowlus measures the force and direction of prevailing winds before longest glider flight.

THEN, suddenly, rising out of the west like a cloud of black smoke, a heavy squall appeared. Soon the moon was covered and the sky became totally black. About 3:30 A.M. the wind increased, nearly doubling its velocity, and torrential rain began to fall. I could see nothing, neither ground nor sea beneath, nor the sky above. Even the nose of the sailplane was invisible. I was suspended in the midst of a storm—with nothing but my own training and coördination of muscles and machine to keep me up or bring me safely down. By four o'clock I was in the center of the storm, though still maintaining altitude. Then the wind fell to six or eight miles an hour, and I was forced to come down, catch an air current, rise again, descend, catch another current, and so on, dipping and rising in much the same manner as a bird does when battling a strong head-on wind.

"Peaches" Wallace, trained by Bowlus, was one of the first American girl glider pilots. She is shown in the cockpit of a sailplane.

All the time, of course, I was losing altitude a little at a time, until at last I had dropped so far that I could hear, but not see, the tops of the bushes on Point Loma brushing the keel of the sailplane. Though I probably was not more than ten feet above the earth, I could see nothing until I pulled out a small flashlight and was thus able to pick out, fitfully and in deep shadow, bits of the terrain, large white rocks, and dark clumps of bushes at the sides of and beneath my path of flight. Light as was the wind, the sailplane was moving majestically forward in a world of darkness, through which pin points of light from the "coffee fires" of the watchers glowed fitfully.

THE wind continued to drop; the rain seemed to increase in volume; it appeared that I must land. I struggled to gain altitude—fought to prevent the involuntary ending of the flight. I brought to use every trick of glider flying that I knew—and then, all at once and quite out of the air as it were, there came to me a new movement in manipulation of the plane, a new "wrinkle," by which I immediately began to gain altitude.

I found that if I kept my windward wing down as I flew to and fro in a comparatively straight line, I would not drift, and would lose less altitude than if I kept the wings level. It then occurred to me that if I kept the leeward wing down, I would get additional benefit from the air current, no matter how slight, and would gain altitude. I tried this, and immediately began to "crab" upward. In other words, by sliding sideways, instead of straight ahead, the light wind would give me greater lift.

By this trick, (*Continued on page 130*)

Representative W. I. Sirovich, New York, standing at right, asks Congress to create a bureau of narcotics. At right are dope devices.

Why 2,000,000 Americans Are *Dope* Fiends

IN THE United States, one out of every sixty persons is a drug addict.

During the decade from 1920 to 1930, the number of narcotic victims in America has doubled, tripled, quadrupled. One ton a year of crude opium and its derivatives would meet the legitimate medicinal and scientific needs of the nation. Yet, last year, approximately 200 tons were smuggled into America. The amount of morphine consumed is thirty-five times that required; and, with a smaller population than that of Germany, France, and Italy combined, we import ten times as much crude opium as these three nations together.

Such startling figures as these, presented, a few weeks ago, on the floor of Congress by Dr. William I. Sirovich, Representative from New York and a leading authority upon narcotics, have aroused officials to new efforts to stem this tide of habit-forming drugs. The House Ways and Means Committee reported favorably on the Porter Bill, to create a Bureau of Narcotics in the Treasury Department, and the House passed it. Governors of many states began investigations to find how they could best cooperate in fighting the traffic. In New York City, U. S. Attorney Charles H. Tuttle advocated the passage of a law to send dope peddlers to prison for life if convicted a second time.

DR. WM. I. SIROVICH, a leading authority, tells here the amazing facts about the illegal dope traffic, which in recent years has assumed the proportions of a national peril. He is a member of Congress and a physician, and is leading the fight for an international agreement to stem the blighting tide of habit-forming narcotics that pours into this country from abroad.

By

JOHN E. LODGE

What are the causes of the alarming increase in the number of drug addicts? Who are these more than 2,000,000 victims of a body and soul destroying habit? What are its effects on the health and morals of the nation? Where do the enormous quantities of drugs come from? How are they smuggled into this country and then retailed? How can the illicit traffic be prevented? How can narcotics be restored to their rightful place as a reliever of pain and kept from becoming a plague?

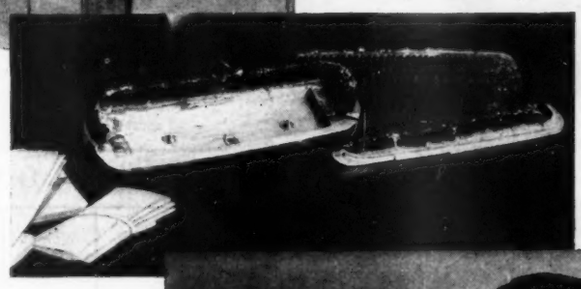
Recently I asked Dr. Sirovich to answer these and other questions for the readers of POPULAR SCIENCE MONTHLY. As superintendent of a New York City hospital and a Fellow of the American College of Surgeons, a legislator and one of the leading spirits in America's fight against the drug traffic, he has had wide opportunity to study the subject from all angles.

The problem, I found, is an exceedingly complicated one, even more involved on account of its international aspects. To begin with, the reasons for the shocking increase in narcotic consumption in the past ten years cannot be understood without a knowledge of who and what drug addicts really are.

In the public mind, narcotics are generally associated with crime and criminals. But though lawbreakers, especially holdup men and murderers, often are dope fiends, they are by no means the only users of drugs. There are addicts among the rich, the poor, and those of the middle class; among the socially respectable and members of the underworld; among the educated and the ignorant. Yet, in the main, they belong to one group; in the words of Dr. Sirovich, they all are "psychopathic constitutionally inferior types."

"They are mostly men and women," he explained, "who are afraid to face the

Smugglers are ingenious enough to make use of anything to get their stuff into America. Here is a shipment of brushes used to deceive customs officers.



At right, one of the brushes used in this smuggling act is enlarged to show how bristles came out of false back which was then filled with drugs.

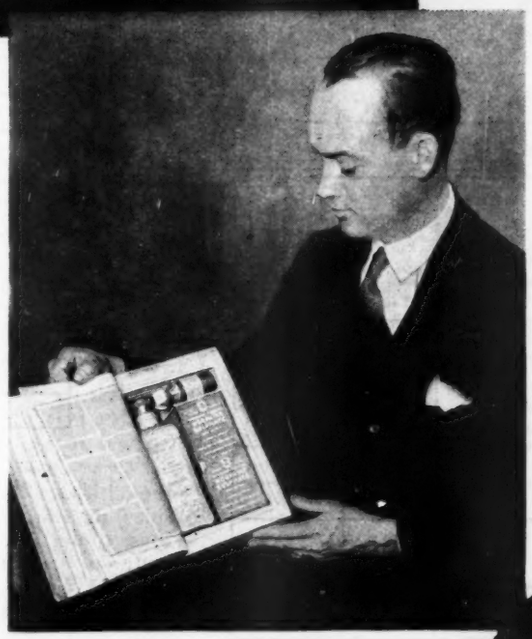
unpleasant realities of life; in other words, moral cowards. To escape from the hard world of reality, with its pain, failure, disillusionment, unhappiness, and worry and to cross into a world of fantasy and oblivion they use four bridges—the bridge of opium, the bridge of morphine, the bridge of heroin, the bridge of cocaine. To return, they also have to cross four bridges—the bridge of sighs, the bridge of humiliation, the bridge of degradation, the bridge of infamy.

"There are five principal reasons why this type of person first takes up narcotics. Four of these are physical; the fifth mental. The physical incentives are pain, sleeplessness, inflammation or irritation of all kinds, and digestive disturbances. The mental condition that causes thousands of people to turn to drugs is lack of courage or initiative. They take dope for sustenic purposes; that is to say, as a stimulant to bolster up their nerve."

Now up to 1920, Dr. Sirovich told me, a large percentage of this latter group used liquor as a stimulant. But when, on January 16, 1920, Prohibition went into effect, they found their supply either cut off entirely or hard to obtain. Many feared the poison in denatured industrial alcohol that flooded the bootleg market in the first years of Prohibition. And so they turned to dope. Another factor that contributed to the increase in addicts was the fact that a number of bootleggers, after plying their trade for a while, found it easier, safer, and more profitable to handle dope than booze. Peddling drugs does not require transportation of goods in large bulk, detection is harder, and there is no danger from hijackers. Thus, he maintains, Prohibition was one of the chief causes for the increase.

"Official figures bear me out," he said. "In the year 1919–1920, 250,000 pounds of crude opium were imported into the United States. The following year, with the Eighteenth Amendment and the Volstead Act on the statute books, the imports leaped to 950,000 pounds, almost four times the quantity."

The manufacturers of narcotics, he explained, were fully aware of the change in conditions in this country. They speeded up production and unloaded their stuff on the United States by every conceivable means. And though liquor is now easier to get and also less dangerous to drink than in the beginning of the Prohibition era (P. S. M., May '30, p. 19), this overproduction of narcotics has continued, making illegal importation and sales the only way in which the drugs can be disposed of. Moreover, the drug habit is progressive, and it is safe to say that few if any former drinkers returned to liquor once they had taken up dope.



A harmless-looking Bible, seized by a narcotic agent, contained a large quantity of dope.

Virtually all the drugs which are used illegally in America come from foreign countries. There are just fifty-four narcotic factories in the world, four belonging to the United States. This makes the drug problem an international one and therefore even more difficult to solve than the Prohibition question, which is almost wholly national in character.

The location of all the production centers is known. Thus the source of all illegal dope can be traced. But before the traffic can be stamped out, an international agreement, a sort of "narcotics League of Nations," is necessary. At present, the only countries refusing to sign such an agreement are England, France, Holland, and Switzerland—all large producers of opiates. England owns the greatest number of narcotic factories. Switzerland, which has several, makes two pounds of drugs a year for its own citizens and sends twenty-three tons, or 46,000 pounds, to other lands.

Dr. Sirovich proposes that an international convention be called by President Hoover in 1931. Representatives from all countries would meet in Washington to engage in a world-wide antidrug crusade. This move, he believes, would focus public attention upon the nations that yearly are increasing their output of narcotics, destroying unfortunate men and women mentally, morally, and physically for the enrichment of the drug-factory owners.

The only solution for the increasing use of drugs, Dr. Sirovich declares, is to stop the flood at its source. The total output of the world's fifty-four factories is more than a thousand tons a year. Three tons would meet the legitimate requirements of the entire world. The number of production centers, he feels, should be limited by international agreement. As battleships are sunk by naval agreement, he proposes that forty-eight of the narcotic factories be "sunk," leaving six to carry on the work of supplying the opiates really needed for medicinal and scientific purposes. The owners of the abandoned factories could be reimbursed from a fund raised by public subscription.

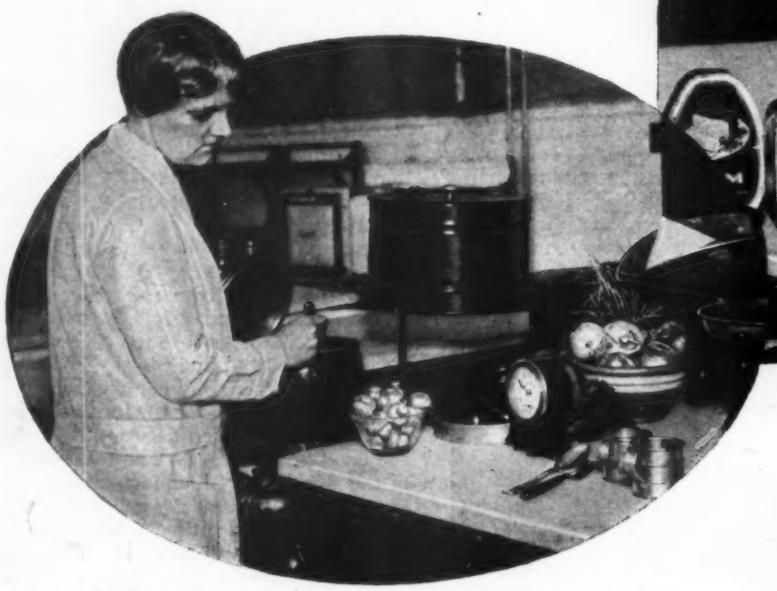
But until this solution is reached, drugs will continue to claim new victims, undermining their health, dulling their minds, destroying their moral fiber. Incomplete statistics, the only ones available, indicate

(*Continued on page 134*)

The heel of a shoe makes a convenient and safe place to carry morphine. This shoe, with dope in the heel, was seized by the drug squad.

A New Light on Canned Food

Convenience and cost of "fresh" or "tinned" meals compared in a test made for you by dietary experts.



Miss Ruth L. Parrish, instructor of Household Arts, Teachers College, Columbia University, New York City, timed the cooking of her test dinners.

In her analysis of canned and fresh foods, Miss Parrish made careful record of the weight and cost of the items on her menu. The figures for one meal are given in the tables on this page.

Fresh — MENU No. 1

Dish	Weight as Purchased	Weight after Cooking	Cost	Time of Preparation	Time of Cooking
Grapefruit	1 lb. 3½ oz.	.....	$0.25	16 min.	.....
Baked Ham	4½ lb.	2 lb. 11 oz.	1.55	15 min.	3 hr. 40 min.
Candied Sweet Potatoes	3 lb.	1¾ lb.	.25	12 min.	55 min.
Buttered Spinach	3 lb.	1 lb. 14 oz.	.25	37 min.	20 min.
Stewed Tomatoes	2½ lb.	2 lb.	.25	11 min.	25 min.
Fig Pudding	.....	1 lb. 14 oz.	.405	40 min.	3 hr. 30 min.
Other ingredients used such as butter, eggs, sugar, milk, suet, spices, etc		.....	.211	.....	.....
Total cost of meal		.....	$3.166	2 hr. 11 min.	8 hr. 50 min.

Canned — MENU No. 1

Dish	Weight as Purchased	Cost	Time of Preparation	Time of Cooking
Grapefruit	1 lb. 4 oz.	$0.25	5 min.	.....
Baked Ham	3 lb. 3 oz.	2.20	10 min.	30 min.
Candied Sweet Potatoes	2 lb.	.25	12 min.	30 min.
Buttered Spinach	1 lb. 11 oz.	.25	3 min.	6 min.
Stewed Tomatoes	2 lb. 1 oz.	.25	3 min.	8 min.
Fig Pudding	14 oz.	.50	2 min.	30 min.
Other ingredients such as sugar, butter, spices, etc.....		.22	.....	.....
Total cost of meal.....		$3.92	35 min.	1 hr. 44 min.

WHEN you sit down to dinner this evening, either at home or in a restaurant, the chances are nine to one that at least one of the courses will consist of some kind of canned food. It may be the soup or the vegetables; perhaps the fruit or dessert. Lately, packers have put canned whole hams, chickens, and other ready meat dishes on the market, so it is quite possible that your entire meal may have been prepared from cans.

Convenience is, of course, the chief reason for the present tremendous consumption of canned foods, especially in the cities. Besides, many persons prefer the taste of certain canned foods, such as peas, salmon, and pineapple, to that of the fresh articles.

But what of the expense? Are canned foods cheaper than fresh or dearer? And what is the actual saving in time and labor accomplished by using them? What do experts think of the difference in quality and appearance?

In an effort to find answers to these questions, POPULAR SCIENCE MONTHLY devised a series of comparative tests and engaged an expert to carry them out. They were conducted in the laboratories of the Foods and Cookery Department of Teachers College, Columbia University, New York City, by Miss Ruth L. Parrish, instructor of Household Arts.

With the assistance of some of her students, who participated in the work as a class problem, Miss Parrish prepared three complete, typically American dinners. Each of the meals was made twice—first from canned and then from fresh products. The dinners were planned for a family of five. In each case, the cost, labor, and time involved in preparing the canned meal and the fresh were computed carefully. On three successive days Miss Parrish served one of these double dinners to a committee of five, consisting of members of the faculty and students, who compared the quality, flavor, and appearance of the canned and fresh dishes set before them.

LIKE good jury members, the judges did not allow their personal prejudices, either in favor of fresh or canned foods, to influence their verdict. Moreover, the dishes on the various menus were selected with (*Continued on page 138*)

PROGRESS AND DISCOVERY

Important achievements in engineering, exploration, and discovery, and the latest news of the world's progress in science

HOSPITAL IN AUTO GOES TO PATIENT IN CHICAGO

HOSPITALS that go to the patient instead of asking the patient to come to them are maintained for its employees by an organization serving the Chicago metropolitan area.

They are really traveling bus clinics, elaborately outfitted with the most modern equipment for making physical and mental tests and for giving treatment. The medical department in charge of the four-wheeled hospitals sends them out on "round robin" tours to make periodical examinations of employees to detect and remedy physical defects before they become serious.

Upper left, the bus that carries hospital service to the Chicago patient. In oval, doctor and nurse from the traveling clinic making examination. Above, a nurse is showing how mental tests are given.

MISSOURI STUDENTS RUN MESOTHORIUM FACTORY

THERE is only one factory in the country producing the radium substitute "mesothorium." This is a chemical refinery run by students of the University of Missouri, who yearly produce from $5,000 to $25,000 worth of the precious radioactive substance under the direction of Dr. Herman Schlundt. To Dr. Schlundt goes the credit for perfecting the process of extracting mesothorium from the ore monazite, a brownish mineral found in sand or gravel deposits in the Carolinas and Brazil. He did this while working with the United States Bureau of Mines. Now refineries send concentrated ore to the little chemical factory operated by himself and his students, and the final product is sent to the Federal laboratories for approval.

Mesothorium yields an ideal picture of radioactivity, the breaking down of heavier atoms into lighter ones. Fifteen billion years are required for half a given group of thorium atoms to be changed into mesothorium-1, the active variety. For the next jump, from mesothorium-1 to mesothorium-2, only 6.7 years are required. From mesothorium-2 to radiothorium is a mere matter of 6.2 hours.

The beta particles omitted by mesothorium are negatively charged electrons. They travel from ten to 100 percent of the speed of light. Mesothorium is not so dangerous to handle as radium, since it loses half its strength within 6.7 years. Radium takes 1,750 years to do this.

METALIZED PAPER MONEY DEVELOPED BY SWISS

PAPER money that won't burn, tear, or wear out is said to have been produced by a Swiss inventor, M. U. Schoop, of Zurich. His process is described as spraying paper pulp with a protective coating of tin, copper, or aluminum.

Former attempts to metalize paper have resulted in injuring the fiber; but, according to the inventor, the use of a special atomizer in the new process breaks up the sprayed metal into minute particles and prevents such injury.

Although the metalized banknotes are hard-surfaced, they are said to be elastic and easily handled.

NEW LIGHT TEST SHOWS PEARL TRUE OR FALSE

GENUINE pearls, it is claimed, can now be distinguished from false ones with scientific accuracy. An English expert, H. C. Hopkins, has found that the concentric layers forming a true pearl may be identified by the particular way in which they reflect and transmit light. He has devised a special instrument which uses light from mercury vapor to detect this power of true pearls. Hence the fear that true pearls would lose their value because of the Japanese "cultured" variety is no longer well founded. Up to the present the Japanese pearl, produced by inserting a bit of mother of pearl within the oyster's shell as a nucleus to stimulate pearl secretion, has held its own with the true Oriental gem.

The Chinese were the first to discover that pearls grow inside the oyster about some irritating foreign body. They tried to create a substitute for the natural process by planting bits of mud or wood within the shell and putting the oysters

in vats for three or four years. But the pearl thus produced lacked the genuine luster.

In the natural pearl making process, a worm invades the oyster's home, causing the oyster to secrete layers of "nacre," or pearl substance, about the intruder and eventually building up a sizable gem. The Japanese came closer to this process when they embedded chemically treated fragments of mother of pearl in the oyster and got a pearl with a luster.

HEAT SENT TO EARTH BY STARS MEASURED

LOOKING up at the stars on a cold winter's night, it is hard to believe that any warmth from those distant suns could reach the earth. But heat from them, in infinitesimal amounts, does penetrate the earth's atmosphere. Leland B. Clark, research assistant of the Division of Radiation of the Smithsonian Institution, Washington, recently has measured it.

Minute quantities of heat are ordinarily measured by radiometers and thermocouples. The radiometer, an exhausted glass vessel inclosing a little vane which rotates when exposed to light or heat rays, is used for measuring the intensity of radiant energy, such as comes from a star. The thermocouple, made by joining two metal conductors at their extremities, produces an electric current in the presence of heat. Clark's aim was to develop a super-sensitive type of each of these instruments. He did this by using high-vacuum apparatus. The extra sensitivity was made necessary by the difficult task of gaging such small amounts of heat.

FORTUNE THROWN AWAY IN SUGAR BEET TOPS

IT IS in the power of American beet "toppers," who clip the tops of sugar beets on western farms, to save ten million dollars in sugar yearly. If they will do their beet cutting one and a half inches higher than they are now doing it, claims Dr. Ernest Reed, of Syracuse University, they will swell the beet crop by one tenth. Dr. Reed, who is a botanist, was skeptical of the theory, held by Ettore Molinari, eminent Italian chemist, that the sugar in beets is found in the heart only.

Upon investigation, Dr. Reed discovered that the top part of the beet is also rich in sugar content. Going on the old theory that the heart of the beet alone has any sugar, the "toppers" have been accustomed to clip off not only the leaves but the supposedly worthless top section, which, Dr. Reed says, contains an added fortune for sugar beet growers.

NEW HARMLESS BLUE DYE FOR FOOD IS FOUND

RESEARCH chemists have discovered a harmless blue dye for coloring foods. It should be useful to the housewife, the candy maker, and the brewer of soft drinks. Food to match blue breakfast dishes may now be had. The new dye is called Brilliant Blue "FCF." It probably will replace indigotine, the blue dye now in use, but which because of fading has not proved entirely satisfactory.

Before "FCF" was put on the market, it was subjected to rigid tests in the laboratories of the United States Department of Agriculture. There large doses of it were fed to guinea pigs, rabbits, dogs, cats, rats, and mice. They showed no ill effects. Even water animals were placed in the dye solution. Imagine goldfish swimming about in a laboratory aquarium colored deep blue! But "FCF" met the exacting requirements of the Food, Drug, and Insecticide Administration and it was found that it could hurt no one.

In this laboratory, chemists of the Department of Agriculture test all food dyes. In oval, FCF, a brilliant new blue dye, is tested on rabbit.

UNDERGROUND LAKE MAY WATER NEBRASKA FARMS

A SUBTERRANEAN lake, lying less than 150 feet below more than two million acres of farming land in southwestern Nebraska, may be tapped to water crops and eliminate droughts if a plan advanced by Professor A. L. Lugn, of the geology department of the University of Nebraska, is adopted. Professor Lugn made a survey of 750 wells in the valley of the South Platte River. He found that the water of the subterranean reservoir can be lifted to the surface by drilling holes from seventy to 150 feet deep.

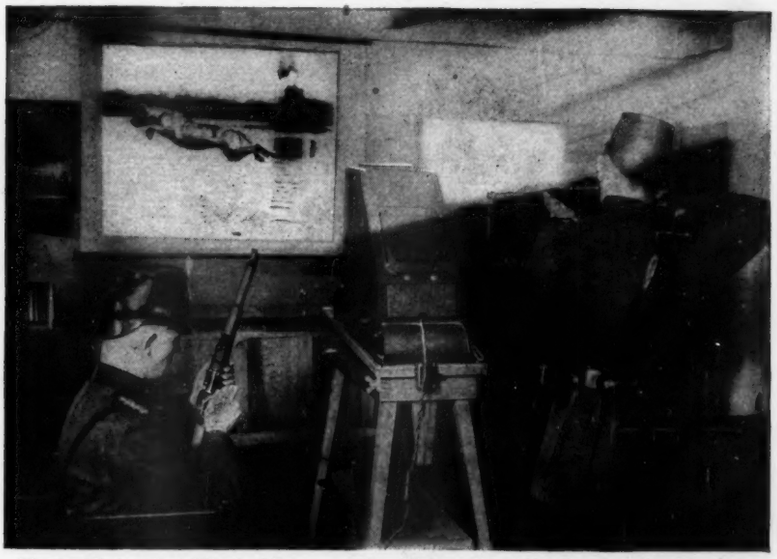
In summer the Platte River is comparatively dry throughout 200 miles of its course. This is due to the fact, according to Professor Lugn, that the stream flows over a porous sand and gravel bed so that much of the water disappears underground when it is most needed by the crops. By tapping this store of subterranean water, Professor Lugn thinks, farmers can insure plentiful yields even in dry years.

SILVER AND ALUMINUM IN HUMAN HEART

SUCH figurative expressions as "a heart of gold," "the iron fist," and "with leaden feet" are recalled by the recent investigations of two French chemists. Through spectroscopic examination of the ashes of human organs, they found there are copper, aluminum, and a little silver in the heart; copper, aluminum, and traces of the rare metal, titanium, in the lungs; cobalt, nickel, and lead in the pancreas; copper, lead, and silver in the liver; aluminum, silver, and copper in the kidneys and the near-by adrenal glands; and silver, tin, and copper in the spleen.

The brain appeared to be rich in tin, and this metal was also found in the thyroid gland, in the neck, which also contained silver, copper, lead, and zinc.

Artificial Light Feeds Plants. These bottles contain plants but no soil, and no sunlight is permitted to reach them. They are being raised at the Smithsonian Institution, Washington, D. C. in an investigation of the effect of various kinds of light and heat waves on plant growth. Each plant in this experiment is treated with artificial light of a different color.



Trained to Get Their Man on the Run. Members of the Berlin, Germany, police force are taught to shoot at running objects by pictures thrown on a screen by a movie projector that gives an illusion of life to the targets. Sharpshooters are required to make good scores at this practice work before they can join the regular squad. Animals racing across a small screen are difficult to hit even at short distances, as here.

Hospital for Sick Birds. Science is coming to the aid of feathered pets in a hospital at St. Louis, Mo. In the picture above Dr. W. E. Reisner, bird specialist, is performing an operation on a ring neck dove.

Changing a River's Course. The River Alt, which flows into the Irish Sea at Crosby, near Liverpool, England, is wearing the coast away so fast that the inhabitants have become alarmed. As a result, engineers are now at work trying to change the course of the river. This picture shows an explosion of dynamite used in blasting a new bed for the Alt. Sand and mud from an area 100 yards square were thrown 500 feet into the air.

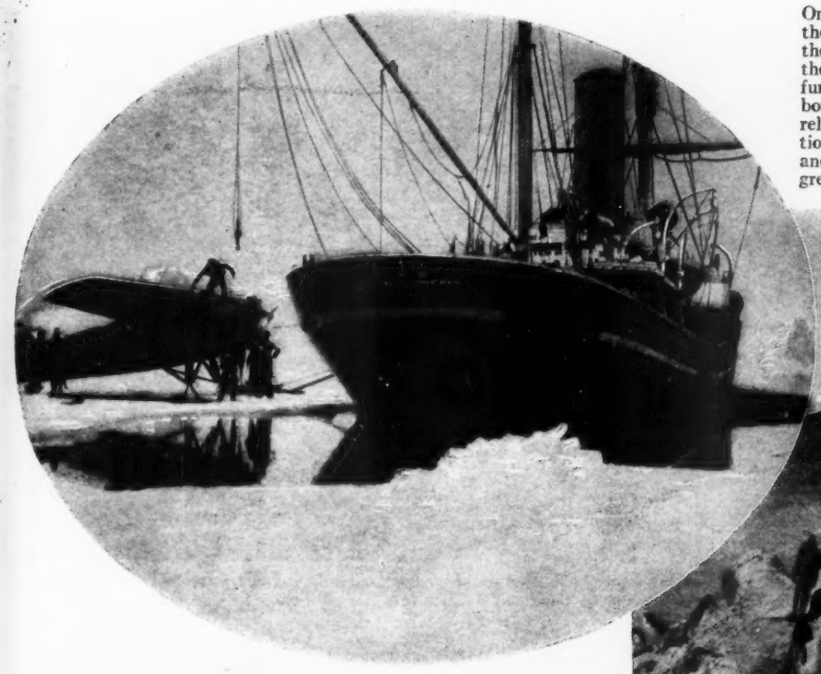
Road Making Tractors Reach China. One of the most recent sections of the world to be motorized is Manchuria, China. There these big road making machines were put to work on a highway leading into Mukden. An American firm scraped and graded a mile of roadway in four and a half hours at a cost of $30. If this work had been done under the old system of manual labor, still largely in use in China, even at the low rate of such labor it would have cost many times as much. The press of Manchuria hailed the advent of the tractors as marking a new era in the history of the nation.

Sir Hubert Wilkins Films Antarctic

A huge amphitheater in which nothing goes on but the silent drama of the frozen world. It is called Port Lockroy and is a bleak harbor of doubtful refuge. It was explored by Sir Hubert during his second expedition to this region which started on Sept. 28, 1929. He sailed for home from Buenos Aires, South America, on February 26 last.

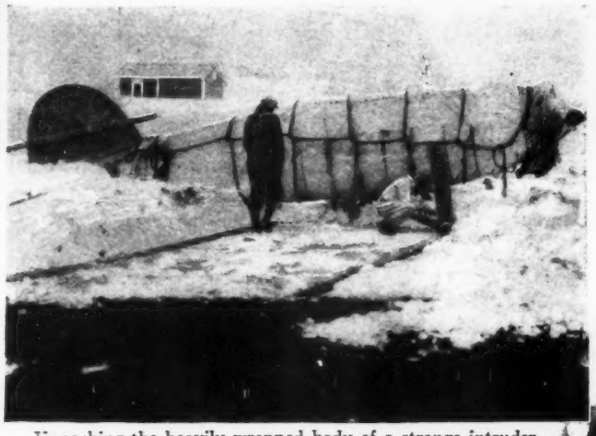
It would be hard to get a better mascot for a polar expedition than a penguin. This bird of the frozen wastes, which walks like a man, is distinguished for its tenacity of life, valuable for those who invade these unknown parts of the globe where the temperature is always subzero.

On a ship within a ship. Members of the Wilkins party taking their ease on the fuselage of the *Los Angeles*, the airplane of the expedition, aboard the base ship, *William Scoresby*. Orval Porter, mechanic, is on the left; pilots Al Cheesman and Parker Cramer come next, with Sir Hubert himself standing in rear.. Deception Island, a pin point of land south of Cape Horn, was chosen as a base. Thence the explorers flew 600 miles into the South Polar regions gathering data for a map of a hitherto unknown coast line and discovering new seas and islands. Obstacles in the way of using a submarine in exploring the Antarctic regions were also carefully investigated by the party.

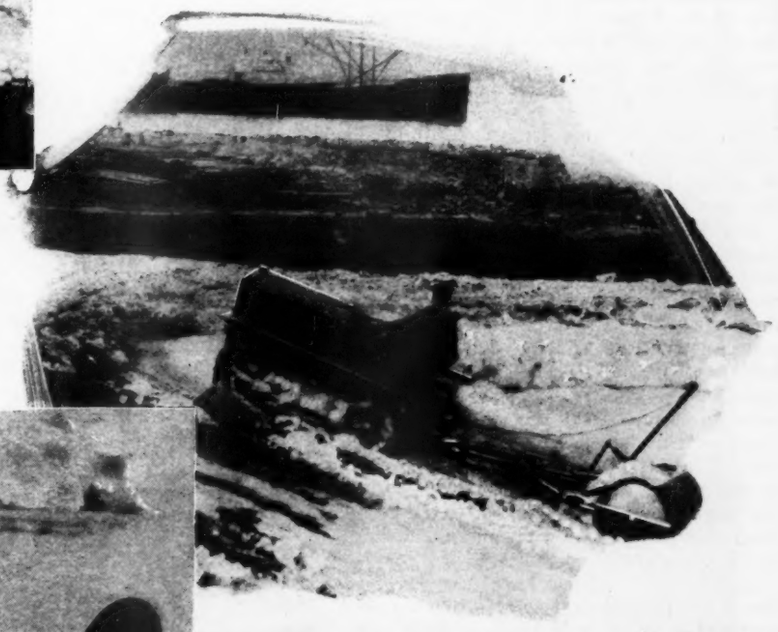


One hundred and fifteen miles from the nearest land, the *William Scoresby* dropped anchor. From here the *Los Angeles* took off on a daring flight into the desert of snow and ice. Sir Hubert believes further study will show shorter routes across the bottom of the world and provide data for more reliable weather predictions. Meteorological stations established at logical points between Ross Sea and Graham Land, Sir Hubert thinks, would be of great benefit to weather specialists the world over.

Making an afternoon call in the world below the Antarctic Circle. This group of polite but inquisitive penguins paid due respect to the strangers who carried odd black boxes. The photo was taken on an island lying within the hook of the extreme southern point of South America. Sir Hubert, whose photographs of his latest trip are remarkable, took the first aerial photos in the North.

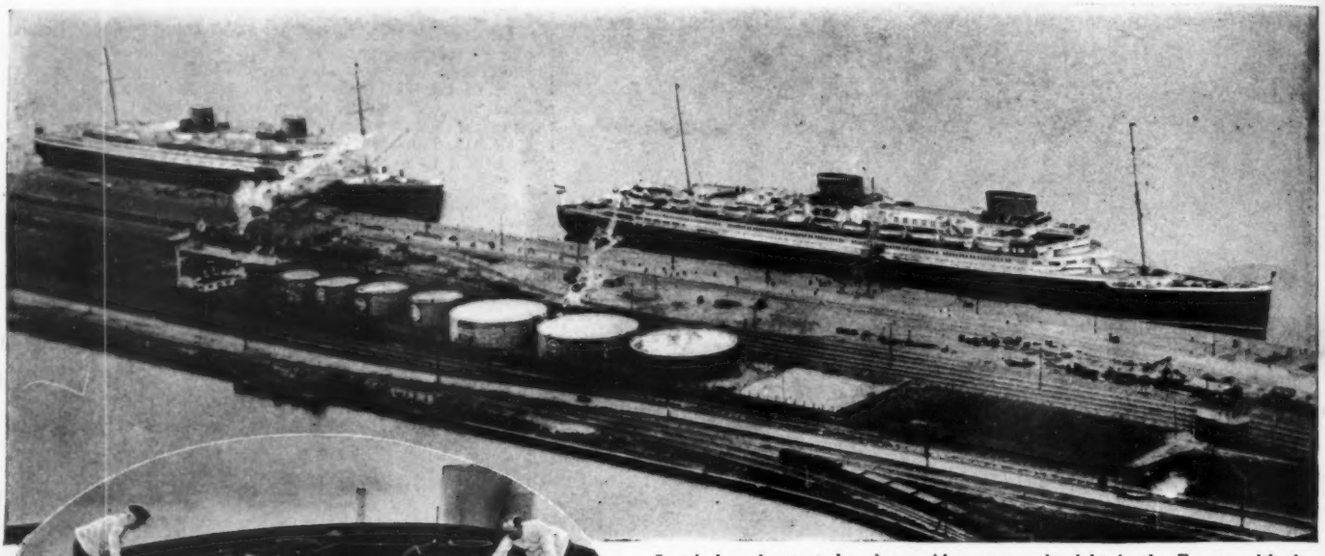


Unpacking the heavily wrapped body of a strange intruder into the wild Antarctic. The airplane made possible the survey of the icebound realm at both the North and the South Pole regions. Without its aid, such survey would have demanded years of conflict with the indomitable forces that fought back and defeated the hardy early explorers. As long as the plane flies, and has a base to which to return, it is safe from the destructive power of the ice packs and waves.



A symbol of modern industry at one of the outposts of civilization. This tractor is being used at the base of Sir Hubert's expedition, Deception Island, to make a runway from which the plane may take off. Planes that rise from the snow use skis, which are found to be well adapted for this important service.

All ready for a 600-mile flight into the ice-locked unknown. The plane *Los Angeles* was used for this remarkable trip which resulted in the charting of 300 miles of mysterious coast line belonging to a little known polar continent. One of the expedition's outstanding discoveries was the fact that Charcot Land, previously thought to be an integral part of the continent, is an island with no connection with the mainland.



Just before she started on her maiden voyage. At right is the *Europa* with the *Bremen* behind her. Note size of funnel, one of three inside smokestack in oval.

WHY *EUROPA*, ON FIRST TRIP, BEAT *BREMEN*

THE speed supremacy of the sea has again changed hands. The *Europa*, sister ship of the *Bremen*, took the laurels from the latter vessel in a race against time and weather that astounded even the commanders of the *Europa*. The new queen's time for the Atlantic passage was four days, seventeen hours, and six minutes. This was thirty-six minutes under the record set by the *Bremen* on her maiden trip last July (P. S. M., Oct. '29, p. 22).

Are there points about the *Europa* which account for the ease with which she made the startling passage? Engineers might mention several things. The two ships are twins in size, tonnage, and general construction, but they differ in certain particulars. The feature of each vessel, the "bulbous bow," is much more pronounced on the *Europa*. The shape of this bow is said to give "dead water" at the propellers, which adds to the power of their thrust. Also the *Europa's* bow seems to rise straighter from the water than that of her sister, and is broader.

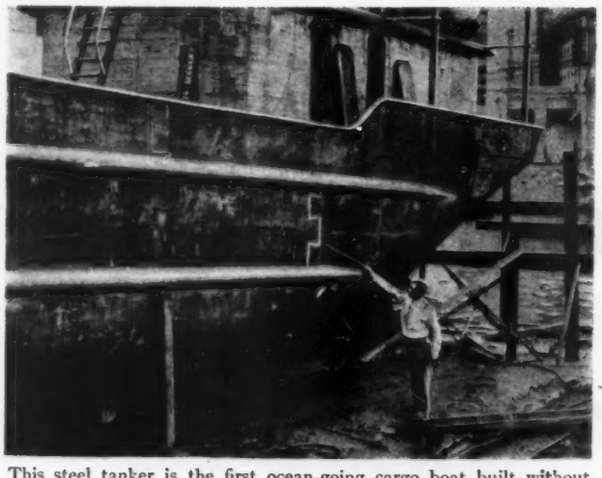
Another unusual feature of the *Europa* lies in her propellers, two of which rotate outward or away from the ship, and two inward or toward it. Complete freedom from vibration at the stern is claimed for this arrangement. All four of the *Bremen's* propellers rotate outward. Each ship is equipped with high pressure steam turbines, which are the most recent important construction feature of high speed vessels. But the *Europa's* engines are said to develop 20,000 more horsepower than those of the *Bremen*.

Aside from points of construction contributing to speed, the *Europa* has various other new features. To keep the smoke away from the decks, the funnels of the *Europa* are equipped on the interior with devices that force the smoke upward a considerable way before it blows out to sea. Antirolling tanks, which add to the comfort of the passengers, have been installed. The entire hull of the ship, to insure it against disaster on the high seas, is divided into fifteen water-tight compartments.

Commodore Nicolaus Johnsen, of the *Europa*, is at the microphone on his ship at the New York end of the record-breaking maiden trip.

NOT A RIVET USED IN THIS STEEL TANKER

WITHOUT a rivet in its 120-foot steel hull, a new oil tanker recently was launched at Charleston, S. C. It is said to be the first electrically welded ocean-going cargo vessel. The arc welding was done with dovetailed or lock-notched plates, developed by Richard Smith, ship designer. Only nine workmen were required to assemble the ship, and instead of the 85,000 pounds of rivets, only 8,000 pounds of welding wire were used. Smith estimates that constructing ships without rivets saves a fourth in cost.

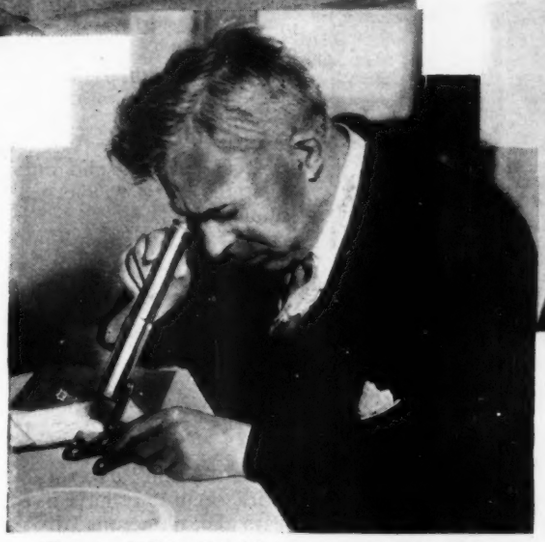


This steel tanker is the first ocean-going cargo boat built without rivets. The white line shows lock-notch in plate at point of welding.

COLORED SAND TO TRACE HAWAII'S FLEEING BEACH

RED, green, and blue streaks will appear shortly on the white sand of the famous beach at Waikiki, Hawaii. They will be put there by engineers of the Department of Public Works.

Reclamation work along the shore has been hindered by the sea. A stretch of beach, filled in, would be carried away by the ocean within a month. The direction of the destructive sea currents, which would give a clue to the place where the lost beaches go, is unknown. On the suggestion of Dr. Douglas Johnson, of Columbia University, large areas of the beach will be covered with colored sand. Thus it will be possible to trace the movement of the shifting shores.



Tons of Dirt in Air. By means of the automatic air filter, above, and the microscope, meteorologists find that New York City's air contains on an average 2,100 tons of dust, made up mostly of carbon.

Seeing Pulverized Rock in Air. With this device a sample of air is drawn in by suction and appears against the slide of a microscope where the specks of dust are counted. This shows an average of 38,000 particles in a cubic foot of New York's air. These tests are being made by a firm interested in house ventilating.

Teletype Aids Search for Crooks. Philadelphia police are using the teletype to broadcast descriptions of criminals. The machine has a keyboard similar to that of a typewriter and the operation of its keys sets going the receiving machines that type the message. A single wire can carry six transmissions either way at the same time. Above, Philadelphia's Superintendent of Police William B. Mills, at the keyboard, Mayor Mackey, at left, and Director of Public Safety Lemuel Schofield are watching the operation of the teletype.

Police Taught Tricks of Gunmen. Finding the weapons on a gangster is not as simple as it sounds, because he has strange places for concealing them. This dummy, loaded with murderous devices and wearing a bullet-proof vest, is shown to officers in the New York City police college to teach them how to "frisk" a crook and be sure that they have not overlooked any of his guns, bombs, or knives. Failure to find a well hidden weapon has cost the life of more than one officer, and the present instruction is meant to insure a complete "frisking" of the suspect before he is turned in. In the picture, the arm holster and hidden pockets for guns can be seen, though these are by no means the only hiding places.

POSTMEN USED TO TEST TANNING PROCESS

ONE of the most unusual scientific laboratories in the world is a pair of shoes. When chemists of the United States Department of Agriculture, in Washington, D. C., recently wished to test the relative wearing qualities of shoe-sole leather produced by two different tanning methods, they sought the aid of postmen, who are proverbially hard on their shoes. In the test, the postman took his shoes to the chemists who equipped them with new half-soles. One half-sole was the result of vegetable tanning processes in which such materials as hemlock bark, chestnut extract, and mangrove bark are used. The other shoe was soled with leather tanned by the chrome process, which employs chemicals.

The number of hours the shoes were worn was recorded and the results tabulated. It was found that the chrome sole outwore its mate in some cases as much as eighty percent. However, it absorbed water faster and was slippery on wet pavements. As a guarantee that the soles would be exactly alike except for the difference in the way they were tanned, the chemists took hides of the best quality, cut them in half, and cut the mated soles from identical positions.

MAN THIRD IN SPEED BUT FIRST IN ENDURANCE

AS A RACING animal man leads the world for endurance and is third in line for speed records, according to a report of Dr. Adolphe Abrahams, of Westminster Hospital, London. Sixty miles per hour may be reached by the grayhound and the hunting leopard or cheetah for short distances, Dr. Abrahams says, but after that the speed limits of the various animals drop off radically. The horse is only capable of forty miles an hour in race-track trim, and man's achievement to date is a little under twenty-four miles an hour. Man compensates for his deficiency in pace by his capacity for endurance. From the hard-earned record of nearly twelve miles in one hour, man's space-time feats range through such near-miracles as 100 miles in a little over fourteen hours, 624 miles in six days, and 3,422 miles in slightly under twenty-four days. This last record, made in the American cross-country Derby of 1928, far surpasses anything that a horse could do.

For women, the maximum speed is 19.4 miles an hour as compared with 23.3 miles for men, claims Dr. Abrahams.

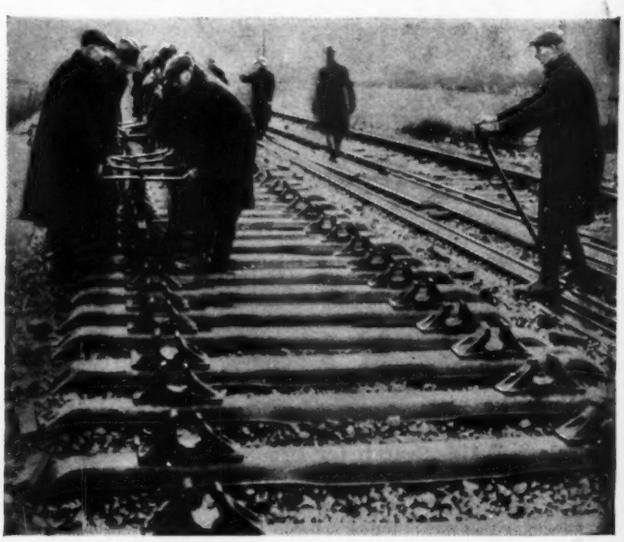
Wearing shoes to test the sole leather, this Washington, D. C., postman starts his rounds.

ENGLISH RAILWAY TRIES 16,000 STEEL TIES

ENGINEERS of the London and Northeastern Railway in England are warily experimenting with a consignment of some 16,000 steel ties for the Grantham-Nottingham Line, one of their branches. This is said to be the first use of steel railroad ties in the British Isles.

The new ties weigh 200 pounds each, about the same as an ordinary oak-wood tie. Metal ties for main line tracks have not been found practical thus far because they tend to interfere with electric signaling systems by establishing connections between rails. Engineers have been endeavoring to invent a method of insulation.

The ordinary wooden tie lasts anywhere from four to fifteen years when it is chemically preserved against rotting caused by growth of fungi. In the United States it is necessary to replace about thirty million ties each year.



On this branch railway in England, steel ties are being laid. Note the "chairs" through which the rails are to be clamped in place.

UNDERWATER HAMMER RUN BY EXPLOSIVES

CHARGES of high explosive drive a novel underwater hammer used for patching holes in vessels below the water line. The device is said to have operated successfully in recent Navy tests, showing ability to make a high speed emergency repair.

The underwater hammer resembles an ordinary pneumatic hammer in appearance, but derives terrific power from the use of explosive instead of compressed air. At a single blow it drives home a three-and-a-half-inch steel stud, half an inch in diameter, through a steel plate of half-inch thickness. These studs, driven through the hull of a vessel by divers, would hold a temporary metal patch over a gash in the side.

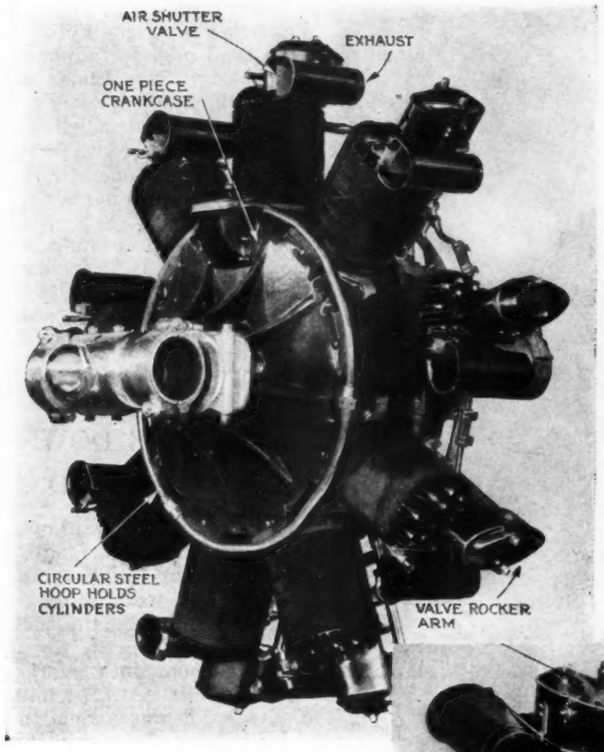
Since the device would drive hollow studs as well as solid ones, it has been suggested as a rescue aid to a sunken submarine. It could pierce the hull with a tube through which liquid foods, water, and air could be supplied to the imprisoned men.

TRACES OF OLDEST TRIBE FOUND IN AFRICA

IN THE primeval forests of southwestern Africa there may have lived, some 10,000 years ago, numerous tribes that preceded every human race whose past has so far been unearthed.

Such is the suggestion of Dr. Viktor Lebzelter, custodian of the American Museum of Natural History, whose theory is based on relics he has found among seventy archeological sites which have been found in Central Africa. Axes of stone, broad-pointed lances intended for use in hunting, and stone catapults all give evidence of a primitive culture which was as far advanced as that of the Stone Age, the earliest period of man's life on earth, according to archeologists, of which any records have been found. A number of these early tribes are believed to have maintained their state of culture until as late as the close of the Middle Ages in Europe.

NEW DIESEL ENGINE DRIVES PLANE 1,200 MILES ON CHEAP FUEL



At left, a close-up view of the new Diesel aircraft engine, showing the single valve that works as intake and exhaust. Note the hoop of steel that fastens the cylinders to the crank case without bolts. Small diagram shows the plunger that forces the fuel into the cylinder under high pressure. Above, Captain L. M. Woolson, left, designer of the engine which has no spark plugs and uses a fuel several times cheaper than gas.

IN THE longest flight yet made by a Diesel-engined airplane, two men recently traveled from Detroit, Mich., to Miami, Fla., without a stop. The 1,200-mile trip, which took ten hours and a quarter, cost for fuel exactly $8.50. Ability to use fuel oil, instead of gasoline, made possible this low expense.

The details of the new nine-cylinder, 225-horsepower Packard Diesel motor which this airplane used, and which is one of a type expected by many engineers to make flying safer and more economical (P. S. M., Aug. '29, p. 21), have just been made public, coincident with its receipt of an "approved type" certificate by the United States Department of Commerce. Not only is it a radical departure from conventional gasoline engines, but it also is something new among Diesel motors. Special engineering features enable it to speed at more than 2,000 revolutions per minute—nearly twice as fast as modern so-called "high speed" Diesels. Another triumph was the reduction of the new motor's weight to only two and a quarter pounds per horsepower, one tenth as much as Diesels previously considered "lightweight."

Cylinders are fastened to the crank case with hoops, instead of bolts, in this novel motor. The hoops encircle the crank case and distribute the shock of explosions in the cylinders.

Two novelties are the use of a single valve for both intake and exhaust, and the individual fuel pumps which spray oil into each cylinder of the motor at the proper moment for firing.

On each cylinder a plunger, operated by an engine cam, rises at the moment of firing, traps a small quantity of oil from a low pressure pipe connected with the fuel supply tank, and sprays it at high pressure into the cylinder.

The Diesel type of engine uses no spark plugs, since the heat of the compressed air is sufficient to fire the fuel.

H. B. Hendrickson, of the Aeronautic Instruments Section, Bureau of Standards, and the plane's ice detector he invented.

ICE DETECTOR FOR PLANE WARNS WITH RED LIGHT

A NEW ice detector for aircraft has been developed and is now undergoing tests at Hoover Field, Washington, D. C.

The new ice warning device was invented by H. B. Hendrickson, of the Aeronautic Instruments Section of the United States Bureau of Standards.

The instrument is inclosed in a weatherproof case mounted on a strut of the plane. When the temperature of the atmosphere reaches the point at which ice is likely to form on the wings, small contacts in the device close, switching on a red light fastened to the instrument board.

INSECTS, NOT BIRDS, FLY LIKE PLANE

THE earliest attempts to find models for flying machines in Nature might have been more successful had insects, instead of birds, been chosen for study. According to a recent announcement of the United States Department of Agriculture, a special study of insect flight reveals resemblances to the design of a successful airplane. In particular, their whirring wings suggest the propellers that have proved the most efficient means of propulsion for airplanes.

After flying their mighty seaplane nearly three miles above the earth, Myron E. Zeller, pilot, and L. H. Gerriott, mechanic, read the barograph record and find that they met the test.

BIG METAL SEAPLANE RISES 15,500 FEET

FOUR tons of airplane and two and a half tons of load soared 15,500 feet high in a recent flight at the Philadelphia Navy Yard.

The remarkable feat was a test of America's largest seaplane, a tri-motored all-metal Ford.

Other tests at the Navy Yard have shown that the 1,275-horsepower plane can leave the water with full load in only seventeen seconds, and can travel 127 miles an hour. The plane's design, adapted from that of a fourteen-passenger commercial machine, makes it suitable for military use as a bomber, ambulance, twenty-passenger troop transport, or torpedo plane.

1,450 BEACONS NOW LIGHT COAST-TO-COAST AIRWAY

AVIATION has a "white way" that outshines the nightly display of New York City's Broadway and other famed bright-light districts. It is a nation-wide chain of about 1,450 airway beacons now in operation to aid night flying, according to a recent report of the United States Department of Commerce.

Most of the beacons have been established by the Government, along air lines which are flown after dark. A few, about 125, are private beacons built at the owner's expense to aid aviation.

LARGEST SEAPLANE MAY CROSS THE ATLANTIC

SOME time in June or July, according to latest reports, the largest seaplane in the world, the giant *DO-X*, will attempt to cross the Atlantic with fifty passengers and a crew of twelve. This is the plane which, last October, carried an official count of 169 persons into the air at once, establishing a world record.

When the monster seaplane takes off from Germany, it will be powered by American motors. Twelve liquid-cooled Curtiss Conqueror engines of 600 horsepower apiece will give it a total of 7,200 horsepower instead of its present 6,000 horsepower. They are expected to add five or ten miles to its cruising speed of 115 miles an hour. The principal reason for the change, however, is said to be the difficulty experienced in air-cooling the rear motors of the tandem-mounted pairs.

On the transatlantic flight the *DO-X*'s route will be via the Azores and Bermuda, where it will stop for refueling if head winds raise the fuel consumption. Following this long hop, the ship may be flown to the Great Lakes and thence westward over the Rockies to the Pacific coast.

CYLINDER HEAD RUNS IN MOTOR

IN A NOVEL motor for airplanes, the cylinder heads slide back and forth. The motor, said to be the first of its kind ever built, is a five-cylinder model of radial design developing 100 horsepower.

It was designed by Lee Bowman, Los Angeles engineer, and is to be submitted to the Government for testing and approval. Connecting rods, operating as in the ordinary steam engine, transmit the power from the moving cylinder heads to the crank shaft.

AIRSHIP, WITH NO PILOT, CAN FLY FOR HOURS

AIRSHIPS may fly without pilots for hours at a stretch through the latest steering invention. Following the successful try-out of his mechanical pilot for airplanes (P. S. M., Feb. '30, p. 22), Elmer A. Sperry, Jr., son of the gyroscope and arc light inventor, has devised a similar automatic steering device for dirigibles. Controlled by a compass, it operates the ship's rudders without human aid.

Another patent has just been granted to the versatile inventor for a launching device for airplanes. This is an inclined runway that would give a plane a downhill start when wheel chocks were released from within the plane.

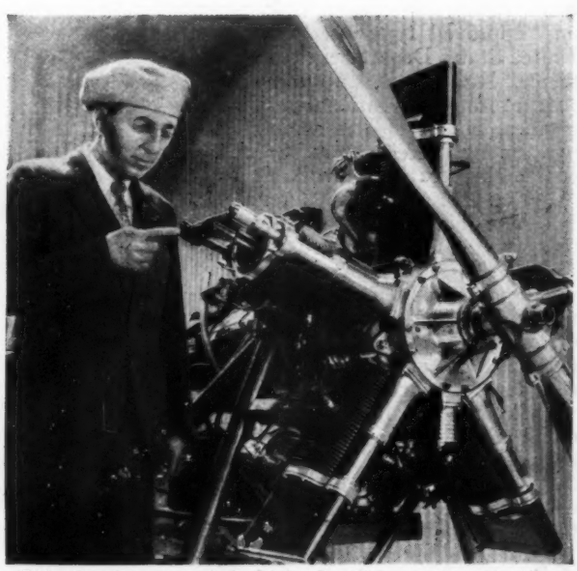
PLANE, UPSIDE DOWN, FLIES BACKWARD

AN AIRPLANE flew backward over Roosevelt Field, N. Y., recently. Incidentally, it was upside down.

Martin Jensen, world's record solo endurance flyer, did the trick by flying at slow speed, about thirty miles an hour, into a forty-mile head wind. Jensen kept himself at a safe distance from the ground by holding the nose of his plane slanted upward, from his upside-down position, making a sort of kite of it during the stunt.

6,600 LICENSED PLANES IN USE IN AMERICA

AIRPLANES have a long way to go to be as common as autos. One in every 19,800 persons in the United States has an airplane. A recent Aeronautical Chamber of Commerce report showed 6,600 licensed planes in service. California and New York led in number of aircraft.



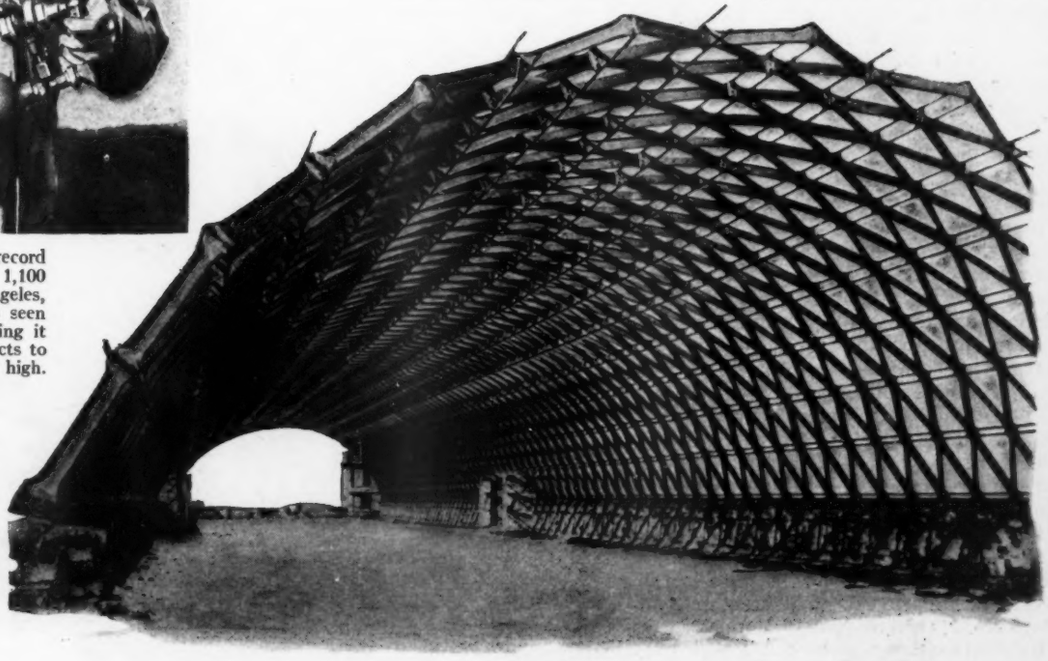
This aircraft motor, designed by Lee Bowman, Los Angeles, Calif., has a movable piston head that imparts its power to the crank shaft through the connecting rods seen at each side of the cylinder. He plans to send it to the Government to undergo tests.

Latest Developments in Realm of Plane and Airship

Six Isotta Fraschini motors with 1,000 horsepower each furnish the driving force for this Italian airplane, called the largest in the world. It was built for use by the army of Italy. At right is a view of the great machine, Caproni 6,000, which in a recent test flight is said to have set six new world records. It is an all steel tube plane with semithick wing section and can be adapted to passenger service. An idea of the huge plane's size can be had from noting the tiny figures of the men standing on and near it.

All ready for a lesson in blind flying. The student is completely hidden in this specially designed cockpit while the instructor occupies the rear seat of a dual control plane. The purpose of this instruction is to teach the student to depend on his instruments as he must do in fog or blizzard.

Germany will lose the altitude record for planes with a pay load of 1,100 pounds if Marshall Headle, Los Angeles, Calif., is successful. Here he is seen with his oxygen equipment, testing it before starting a flight. He expects to fly his plane at least 31,000 feet high.



The steel structure at the right was designed by the Junkers company of Germany as a portable factory and was carried 150 miles into Asiatic Turkey by camels and mules. It is made of small steel parts that can be taken apart or put together easily. It has now been decided to convert it into a portable hangar. It will be used by Persian Air Line planes.

Dogs Are Smart-H

By PRESCOTT LECKY

Department of Psychology, Columbia University

Here is a Paris janitor, and it must be a good one, since it has held the job for nine years. Its master is deaf, so when the bell rings this dog pulls the cord to open the door.

This German police dog knows where the cash is, and with unfailing accuracy picks out its master's wallet from a number that are scattered about.

ARE cats as smart as dogs? Judging from the experimental evidence so far secured, the answer is an emphatic "No." In many scientific tests the dog has proved his superior intelligence. And if the question were put to a popular vote, there is small doubt that the dog would score an overwhelming victory.

But science is not yet ready to hand the dog the palm. The reason is that the cat possibly has not had a fair show. Because the dog is a gregarious, sociable animal that loves its master, is eager to please him, and is fond of praise, it is much easier for it to demonstrate its intelligence than it is for the cat. Solitary by nature and habit, indifferent to its master's attitude and praise, the cat is difficult to "draw out."

Now, however, the cat is going to have its day. In the psychology laboratory of Columbia University, New York City, experiments are under way to find out how smart cats really are. Novel and ingenious, the apparatus used in the elaborate tests resembles the combination of a safe in principle. The question is: Can a cat learn to "open the safe" and, if so, in how many tries?

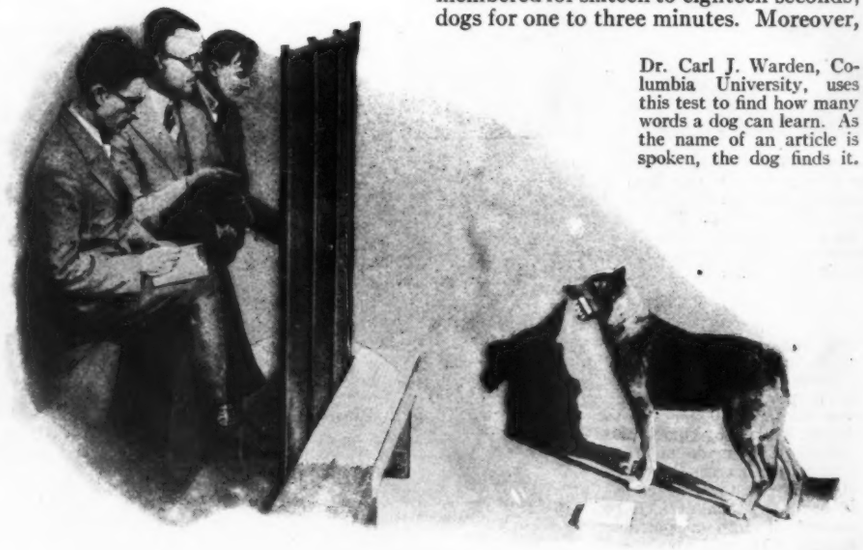
This is how it is done: Three round, flat, wooden plates are set in the floor. They are wired so as to act like electric buttons. Arranged like a safe combination, they open the door of a food box when stepped upon in the right order. For example, the "combination" may be set so that, to get at the milk in the box, the hungry cat must step first on plate No. 1, then on No. 2, then on No. 3. The combination may be 3, 2, 1 or 3, 1, 2.

The tests are conducted in the Columbia animal laboratory under the direction of Professor Carl J. Warden, of the psychology department. It is planned to use the same type of device later for experiments with dogs, monkeys, and other animals.

In previous comparative tests of cats and dogs, the cat has always lost out. There was, for instance, the experiment made some years ago by Dr. Edward L. Thorndike, a pioneer in animal experimentation, who is now professor of education in Columbia. Professor Thorndike tried to find out which animal could manage to escape most quickly from a box. Food in sight but out of reach was placed outside the bars. Each hungry animal could release itself from the box when, by random efforts, it happened to strike the latch that operated the door. Though this comes under the head of a mechanical problem, in the solution of which cats have shown some aptitude, dogs turned in a better performance in practically every test.

A wholly different type of experiment, devised by Dr. Walter S. Hunter, professor of psychology in Clark University, Worcester, Mass., aims to determine how long the animal can stick to a fixed plan of action. The apparatus consists of an entrance chamber facing three food boxes. First the animal is put through a training period in which it learns that the box with a light at the entrance is the one that will open. After the connection between light and food is thoroughly established, the real test begins.

THE light is turned on and the animal, seeing it through a wire netting, prepares to run to the proper box as soon as it is released. But now the light is turned off and the animal kept waiting for a short while. How long can it remember which box was the lighted one? Cats remembered for sixteen to eighteen seconds; dogs for one to three minutes. Moreover,



Dr. Carl J. Warden, Columbia University, uses this test to find how many words a dog can learn. As the name of an article is spoken, the dog finds it.

rt-How About Cats?

Your Pet May Be too Proud to Learn—or Just Stupid. Science Is After the Truth

Above, a cat smiling at the stories told about it. At left, a London cat that, it is said, keeps the door knocker going when it wants to get inside.

in order to remember at all, the cat must keep its head and body pointed toward the box. A dog can turn away and still, in the majority of cases, choose correctly.

Apparently the difficulty for the cat lies in the use of a signal, which requires abstract reasoning. In more recent experiments, the cat saw the food itself placed in the box and the signal was discarded. Now she could remember the right door 67 times out of 100 for periods up to sixteen hours. Unfortunately for the sake of comparison, this modified method was not tried on dogs.

IN ANOTHER still more complicated test, worked out by the well-known animal psychologist, C. V. Hamilton, the dog also defeated the cat. Four doors are provided in the apparatus used in this experiment, all of them leading to food. These doors are kept shut, but one is unlocked for each trial. In no case, however, is the same door unlocked twice in succession. Therefore, the correct method of solution is to try the three remaining doors one after the other. The incorrect way is to try the door that was open before, or to try any door more than once. How did the dog and cat compare in their ability to solve this puzzle? In an equal number of attempts, the dog required 313 trials and the cat 352. Incidentally, the monkey proved smarter than either dog or cat, with a score of 291. That the test is not as easy as it may seem was shown by the fact that a mature person needed 201 trials.

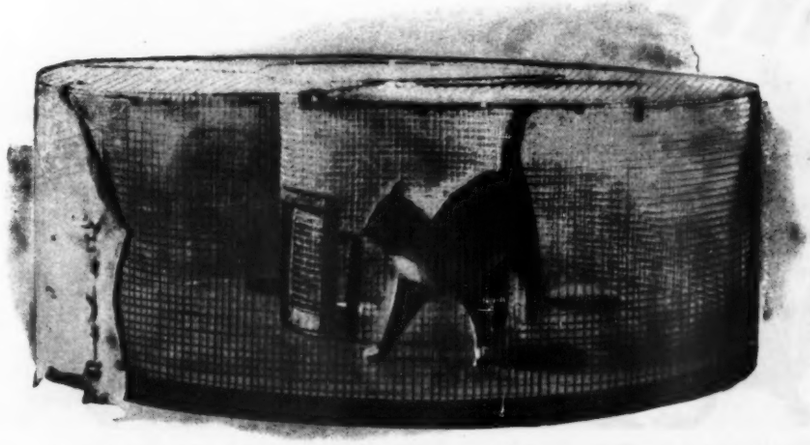
Then there is the question of learning to understand human speech. In this respect, the dog's superiority is unmistakable, though whether this is due to intelligence or is merely a reflection of the greater interest that dogs take in people has not yet been settled. After sixty trials, Professor Thorndike succeeded in teaching a cat to climb to the top of her cage for food when he said: "I must feed that cat." To teach it not to climb at the words "I will not feed her" required 380 trials. But even so, the cat would climb in response to any other remark that was uttered, such as "Nice weather we are having," or "Tomorrow is Tuesday."

On the other hand, Professor Warden and Dr. L. H. Warner, experimenting with the famous dog Fellow in the Columbia psychology laboratory (P. S. M., Feb. '29, p. 25), found that he was able to carry out fifty-three simple commands without a single error.

SO MUCH for scientific experimentation, in which neither animal ever comes up to its popular reputation for smartness. The reason for this may be that a good many laboratory tests, especially the earlier ones, failed to give either dog or cat a fair chance to demonstrate its real ability.

It is outside the laboratory that both dog and cat give their most impressive demonstrations of cleverness. And in the mass of anecdotes gathered by reliable investigators, the dog again comes out an easy winner.

Still, there are a number of apparently well-authenticated stories relating amazing instances of the smartness of cats. The English naturalist George J. Romanes, zoological secretary of the Linnean Society of London, England, tells of a cat whose master was in the habit of throwing out crumbs for the birds. The cat would hide in the shrubbery and attempt to pounce upon the birds as they ate. On one occasion, the crumbs were strewn in the evening. During the night they were covered by a light fall of snow. In the morning the owner saw the cat brushing away the snow and removing the crumbs to another spot, where it put them on top of the snow! Then it hid in the bushes and waited for the birds. This trick (*Continued on page 142*)



The cat in this cage can get its food if it steps on the three plates in the floor in the right order. This experiment, used at Columbia, demonstrates that cats differ widely in memory and ingenuity.

Grow Plants in Electric Beds

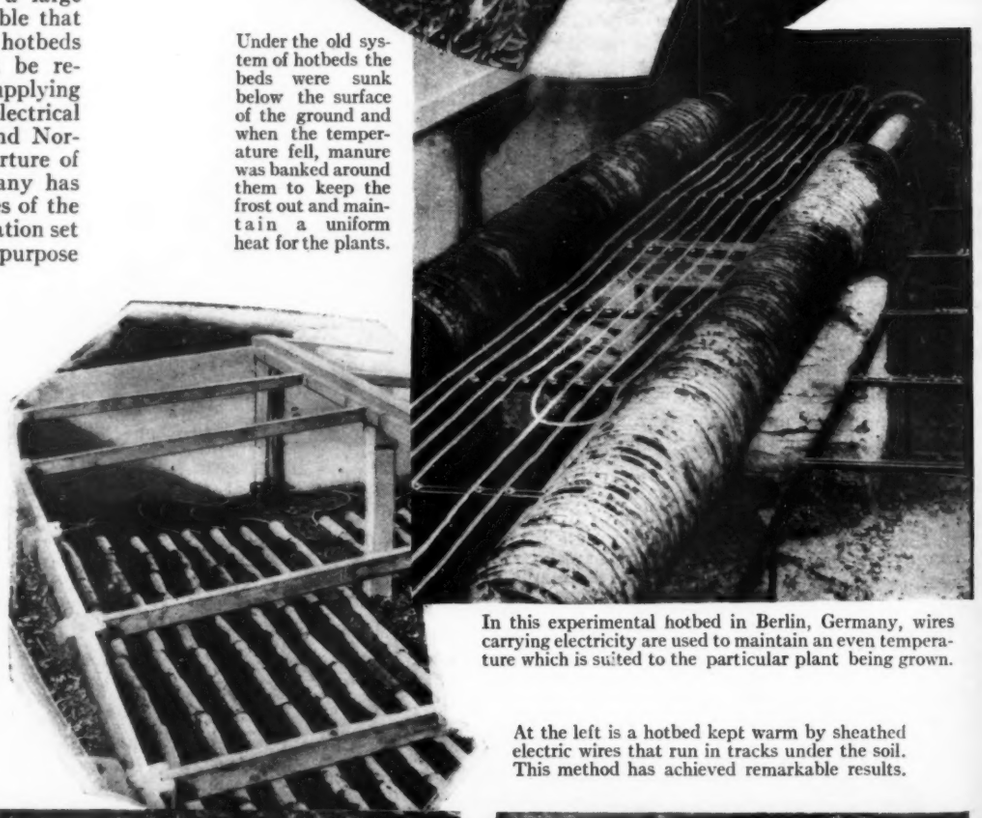
Experiments with hotbeds in Europe, heated with current-bearing wires, show unusual results. Method may be tried by plant growers in America.

ELECTRICITY is now being used to heat hotbeds in Germany. These ingenious "soil" sanitariums, which create an artificial spring season and cause early vegetables or delicate flowers to sprout and grow quickly, are being run by intricate wiring systems carrying electricity at a large nursery near Berlin. It is possible that traditional methods of warming hotbeds with fermenting manure might be replaced by this modern means of supplying warmth from an underground electrical "sun." Inspired by Swedish and Norwegian experiments with the nurture of plants by electrical heat, Germany has now begun to test the advantages of the new method. An experimental station set up in Berlin especially for this purpose announces startling feats of plant growth as a result of electrical heat installation. Wires sheathed in heavy cables are run through the soil directly beneath the plants or else left in the open to warm the entire hotbed.

Hotbeds were invented to improve on nature and force fruits, flowers, and other plants to attain full maturity ahead of their outdoor cousins in the fields and gardens. The design of a conventional hotbed is comparatively simple; a roof consisting of a network of glass windows is supported by a frame of low wooden walls over trenches usually about six feet wide and two feet deep. A moderate incline to the glass roof is desirable, since it permits more direct penetration of the sun's rays. Wood is used for the walls because it is said best to withstand heat from within and cold from without.

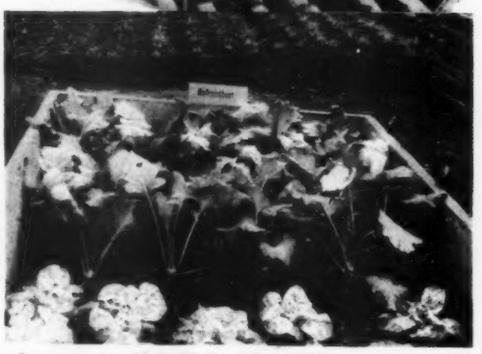
Manure is the ordinary source of heat supply for the hotbed. By its chemical action as it ferments manure may reach a temperature of ninety degrees. By merely turning a switch, however, the horticulturist of the future, will be able to heat his hotbeds as he pleases.

Under the old system of hotbeds the beds were sunk below the surface of the ground and when the temperature fell, manure was banked around them to keep the frost out and maintain a uniform heat for the plants.



In this experimental hotbed in Berlin, Germany, wires carrying electricity are used to maintain an even temperature which is suited to the particular plant being grown.

At the left is a hotbed kept warm by sheathed electric wires that run in tracks under the soil. This method has achieved remarkable results.



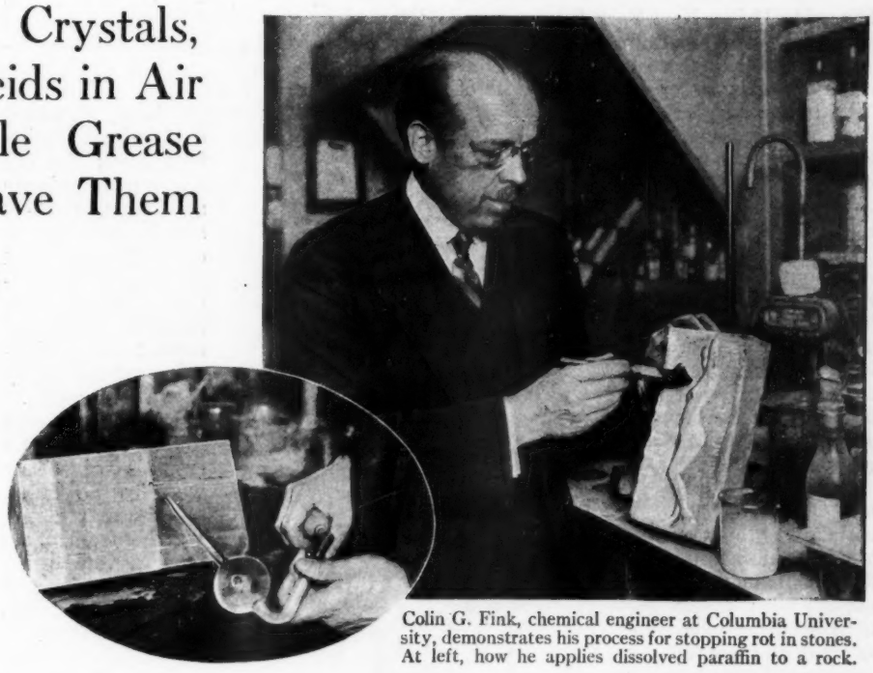
Compare the turnip-cabbages above, grown with ordinary methods, with those on the right. Note the large size of the bulbs of those that were electrically grown.

These electrically grown vegetables show a much quicker and larger development than those kept warm by methods now generally used in American hotbeds.

Rot Hits American Skyscrapers

Builders Alarmed as Crystals, Germs, Frost, and Acids in Air Attack Stone—Candle Grease and Beeswax May Save Them

By H. C. DAVIS



Colin G. Fink, chemical engineer at Columbia University, demonstrates his process for stopping rot in stones. At left, how he applies dissolved paraffin to a rock.

CANDLE grease and beeswax are the main ingredients used in a composition invented by Professor Colin G. Fink, Columbia University chemical engineer, with which he expects to save from ruin a priceless group of ancient buildings and art objects.

The collection of examples of medieval French architecture, statuary, and ecclesiastic art which, it is hoped, will thus be preserved for posterity is the Cloisters, in New York City. It was gathered more than twenty years ago in Europe by George Grey Barnard, famous American sculptor, who brought the fragments of old churches, gateways, shrines, altar pieces, and stone images of saints, kings, goblins, and other exhibits illustrative of the arts of the Romanesque and Gothic periods to this country and here arranged them so as to re-create a corner of sixteenth century France in the midst of a modern American city.

In 1925, the Metropolitan Museum of Art, through a gift of $600,000 from John D. Rockefeller, Jr., acquired the Cloisters. Recently, museum authorities were startled to discover that the Gothic treasures had begun to crumble. In the few years of their stay here, they have suffered more than in six centuries of storms and wars in France. Apparently they have been attacked by a germ disease. While the statues are its chief victims, some of the architectural detail, too, is fast going to pieces. Professor Fink was called to the rescue.

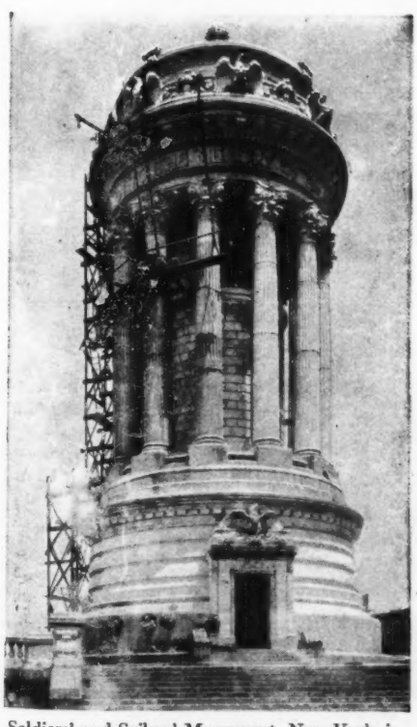
If the chemist's treatment proves successful, a new way will have been demonstrated to save buildings from decay. For, though the fact is not generally realized, stone, the very symbol of endurance, can rot. It hardly seems reasonable, but there are many instances showing that it does rot, and thus endangers the lives of thousands who work, play, live, and worship in or near the rotting structures. However, several effective remedies have been developed.

ABOUT a year ago, it was found that St. Paul's Chapel, the big, brownstone church in lower New York, which was completed in 1766 and still contains George Washington's pew, was going to pieces. Working continuously for eight months, "stone doctors" performed the operation of cutting out fifteen tons of partly and wholly rotted stone! The edifice was treated with hot paraffin, or candle grease, and patched with new stone.

Not eight months but eight years were required to put Cleopatra's Needle, the famous obelisk in Central Park, New York City, through a course of treatment to prevent it from literally crumbling away.

PRESENTED to this country by a Khedive of Egypt in 1869, it was erected in the park in 1881. Two years later, the monument, said to date from the time of Moses, began to shed pieces of rock at the rate of 500 pounds a year! Work to save the needle was started in 1885. The obelisk, it was found, was "scaling." The stone came off in flakes, some large, many more small. One measured twelve by eighteen inches and was four inches thick.

To remove these flakes would have damaged the hieroglyphics carved upon the needle in Egypt centuries before the Christian era. In order to preserve them, all of the flakes that could be saved were left in place. The entire surface of the obelisk was treated with paraffin wax. But meanwhile, each of the hundreds of flakes was mapped and numbered for future reference. In 1893, the damaged areas were treated by pressure to insure that the paraffin wax would fill all voids



Soldiers' and Sailors' Monument, New York, is cleaned before getting protective paraffin coat.

ICE
FROST SPLITS PORES OF ROCKS
ACIDS IN SMOKY AIR ATTACK AND DISSOLVE ROCK
WHIRLWIND
GERMS, DEPOSITED BY DUST, GENERATE ACID IN ROCK
RAINWATER, CARRYING SALTS DRIES AFTER RAIN; SALTS CRYSTALLIZE, BREAKING PORES LIKE FROST

The diagram suggests the four ways that stone rots. The pores let in acid and germs and water, and treatment is necessary or a total loss will follow.

and prevent accidental movement. Now the job was done. Ten years later, a thorough inspection revealed that none of the old flakes had enlarged and no new ones had been added.

The Soldiers' and Sailors' Monument, on Riverside Drive, New York City, a comparatively new structure, was so badly attacked by smoke and frost in the few years following its erection that parts of its stone crumbled to dust at the touch. Recently it, too, was given a coat of paraffin to preserve it. Plymouth Rock, historic Massachusetts spot where the Pilgrims landed from the *Mayflower* in 1620, was cracked in three places when an expert saved it by applying a coat of melted candle grease.

Buildings in Boston, Chicago, Atlanta, and Montreal have rotted so badly that repair men frequently can insert both fists in the holes, or break off pieces of stone with the hands. As a result of this insidious process of decay, some skyscrapers may be in danger of toppling, it was recently suggested by the official journal of the American Chemical Society. Concrete foundations, stated this report, may be reduced to mush by underground waters carrying corrosive chemicals. Only the tenacity of the soil then keeps the weakened columns from spreading. New York, Chicago, New Orleans, and Buffalo are cited in the report among the cities where this underground water may be a real menace in certain cases.

BUT the United States is not the only country where buildings, constructed to withstand the ravages of centuries, are being eaten slowly away. A year or so ago, it was discovered in England that such historic buildings as the Houses of Parliament and Westminster Abbey in London were weakening. The British government department of Scientific and Industrial Research found that fog and other atmospheric conditions were chiefly to blame (P. S. M., Apr. '29, p. 66). Since then, experts of the government's Building Research Laboratories at Watford, north of London, have been experimenting to evolve more durable materials.

What are the causes of stone rot in this country? When the Metropolitan Museum asked Professor Fink to try to save the Cloisters, he at once began a study of the contributory causes, a research so extensive that among the many stones he tested to learn the secrets of their endurance or weakness was a sample of granite from the Egyptian Pyramids.

A similar investigation was started four years ago by Dr. E. M. Chamont, professor of chemical microscopy in Cornell University, Ithaca, N. Y. (P. S. M., Aug. '26, p. 41). Professor Chamont examined materials taken from Queen's College, Oxford, England; Norman walls at Chester, England; the Madeleine Church at Beziers, France, dating back to before 1200; the old Roman aqueducts at Lyons, France; and from other ancient Roman and Norman structures. In addition, he tested bricks removed from modern chimneys after they began to crumble.

Dr. Chamont found that similar crystals of decay were to be found in all the samples, whether from an old Roman wall or an Ithaca chimney built ten years ago. But Professor Fink's investigation went further. Four factors, he told POPULAR SCIENCE MONTHLY, are responsible for the rotting of stone.

A great industrial city burns tons of fuel daily, and its chimneys pour the resulting fumes into the air. Common fuels, such as coal and oil, contain sulphur. When sulphur burns, corrosive acids, such as sulphuric and sulphurous acid, are thrown into the atmosphere. When it rains, drops of water collect these acids from the air, fall with them upon the stone wall of a building, and soak into the porous stone. As if these acids were not enough, every breeze from the sea of a maritime city, such as New York, brings salt into the air. This, added by the rain to the other acids already present, generates hydrochloric acid, another powerful corrosive. This is cause number one.

This building is being coated with paraffin. The hanging charcoal stove preheats the wall.

The second cause is disease. Stone has its maladies, just as humans have. Germs of the sort known as "nitrifying bacteria," which are also found in soil, are carried on the wind (*Continued on page 126*)

Above, Cleopatra's Needle, in Central Park, New York City, gets a coat of paraffin to save its inscriptions from rot, which was causing big flakes to fall off. Below it, the Cloisters, the decay of which was rapid in America though it stood the ravages of centuries in Europe.

POPULAR SCIENCE SCRAPBOOK

News, pictures, and brief bits about unusual people, places, and things from all parts of the world are shown on this and the following pages

MME. FLAMMARION DOES HUSBAND'S WORK

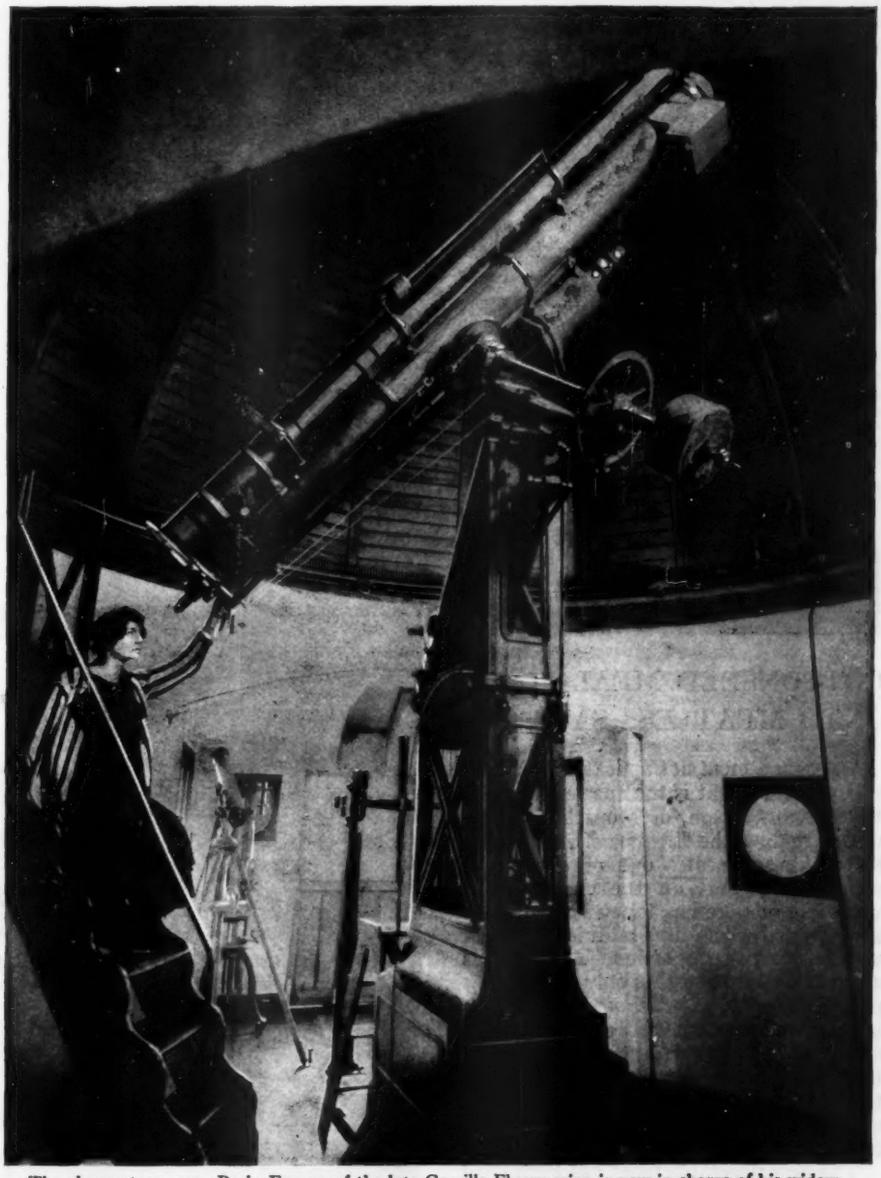
IN THE suburb of Juvisy, on the outskirts of Paris, the widow of Camille Flammarion, the famous French astronomer who died recently, is carrying on her husband's work. Flammarion was known to the public as a popular writer on astronomical subjects, and to the scientific world as an author of various works on the stars and planets, and as an authority on the planet Mars. He was one of the first to suspect the presence of oceans of atomic dust in space, a recent revelation of astronomy (P. S. M., Nov. '29, p. 25). Mme. Flammarion is being supported in her endeavor by devoted friends.

AMEBAS MADE DRUNK BY DROP OF ALCOHOL

THOUGH too tiny to indulge in disorderly conduct, amebas, the one-cell animalcules often called the lowest form of life, can get sufficiently drunk to "walk" unsteadily. This was proved recently by a British biologist, who converted a small quantity of water inhabited by millions of the creatures into a microscopic speakeasy by adding a drop of alcohol. When observed under the microscope later, the amebas were "staggering."

Consisting of a droplet of protoplasm, the ameba moves by a flowing motion of its body. It eats by making its protoplasm run around the coveted morsel. It breathes through the surface of its body, extracting oxygen from the water in which it lives somewhat as a fish gets it through the gills.

In the alcohol experiment the amebas moved awkwardly, erratically. In spite of their response to stimuli, they are not known to have a real nervous system.



The observatory, near Paris, France, of the late Camille Flammarion is now in charge of his widow. A photograph of the new trans-Neptunian planet was recently obtained at this astronomical station.

DAMASCUS STEEL NOW BEATEN IN AMERICA

SWORDSMITHS of Damascus have been forced to yield their laurels to modern American steel workers. Steel is now produced, says W. H. Eisenman of the American Society for Steel Treating, that is harder than that of Damascus and possibly more flexible. He reports that a metallurgist of Canton, Ohio, Dr. W. S. Carnes, has perfected a sword of such fine steel that it may be used as a razor, and yet is so flexible that it can be wound several times around one's arm. The sword is made of carbon vanadium steel.

Vanadium is found combined in many minerals in small quantities and weighs about six times as much as water. It is a silvery white metal that melts at the high temperature of about 3,180° Fahrenheit. It strengthens steel, from which it removes oxygen and possibly also nitrogen.

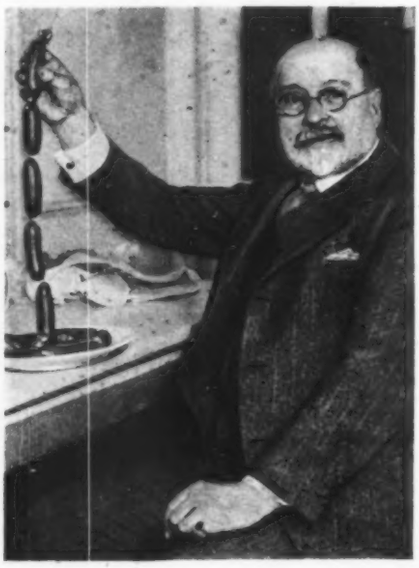
TREE 5,000 YEARS OLD

THREE thousand years before the birth of Christ, a seed sprouted on one of the Cape Verde Islands, off the coast of northern Africa, and developed into what is now one of the world's oldest trees, if estimates of the Portuguese colony of St. Vincent are correct. The ancient "dragon tree" is said to be 5,000 years old. Sometimes they are sixty feet tall and have a crown of short branches, with tufts of sword-shaped foliage.

RELICS OF LEGENDARY THULE IN ALASKA

BELIEF in the existence of a land called "Thule," sparsely inhabited and situated in the remote North, was held by the Greeks and Romans. Today archeologists have some evidence to support the theory of a "Thule" culture. An expedition to Alaska from the University of Pennsylvania Museum has sent back relics found near the northernmost promontory of the country, Point Barrow, which argue strongly that Thule once existed in Alaska. Objects of wood, ivory, whalebone, and skeletons wrapped in animal skins comprise the collection. Some of the objects, claims Dr. J. Alden Mason, curator of the American section of the

museum, are specimens of an early civilization familiar to archeologists as the Thule culture. The excavation at Point Barrow revealed some curious houses, quite unlike the typical Eskimo igloo. Built of whalebone and driftwood, they were rectangular in design and reminiscent of the homes of early Mongolian tribes living on the east coast of Siberia. These tribes, Dr. Mason suggests, may have crossed the Bering Sea into Alaska at a remote period.



COTTONSEED MEAL MADE INTO MEATLESS SAUSAGE

WHEN is a meat not a meat? When it's cotton seed. That is the answer given by Dr. David Wesson, of Montclair, N. J., who has solved the dilemma of vegetarians by making "meat" out of cottonseed meal. An expert on the chemistry of vegetable oils, he has taken cotton seeds and ground them up, adding fats and water in proper proportion. The result is a synthetic meat costing only five cents a pound to produce. Although hardly up to the flavor of a juicy beefsteak, which could be had for forty cents a pound at the cheapest, the cotton meal meat is said to have the food value of other meats owing to its protein content of nearly fifty percent.

The new vegetable meat has been tried as a sandwich filler, and as a basis for sausage, croquettes, and meat loaf.

BIG STONE BULL GOES TO CHICAGO UNIVERSITY

THE great bull of Assyria has been shipped to the University of Chicago. It is made of stone and, centuries before the Christian Era, it guarded the gateway of the palace of the Assyrian king, Sargon II. The massive relic made its journey in eighty-four pieces, and it took an engineer, a draftsman, fourteen carpenters, four blacksmiths, four stone cutters, and 240 natives to get these pieces crated for shipment. The first stage of the trip was made on a trailer fashioned out of old cannon wheels and railroad rails left behind by German troops stationed in the region during the World War.

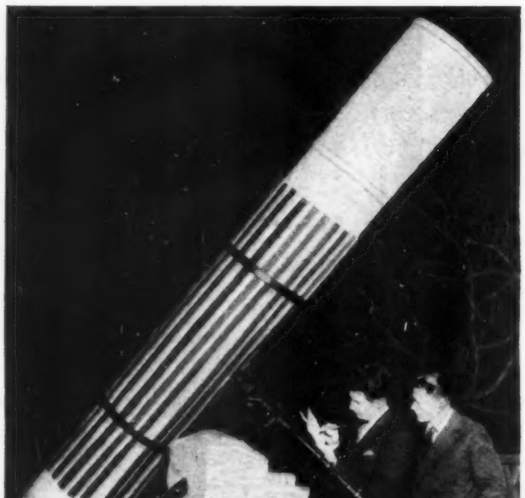
Upon its arrival, it was found to be too large for any of the present university buildings, and so the historic bull will remain crated on Stagg Field until it takes its intended place in a new building.

The Assyrian bull is the latest archeological treasure to be discovered by the University of Chicago's Oriental Institute. The Institute, directed by Dr. James H. Breasted, maintains a base in the Near East, from which field expeditions to excavate ancient ruins, such as the one into Assyria that found the stone bull, are sent.

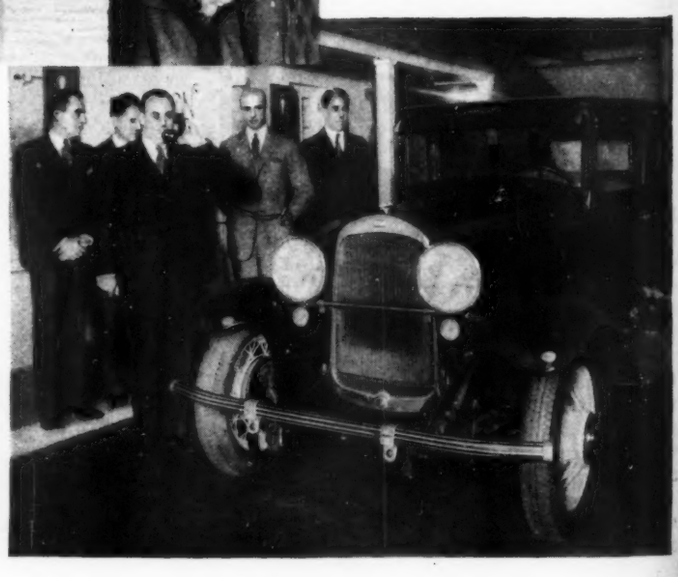
OLD AUTO PARTS USED IN TELESCOPE FRAMEWORK

MODERN Galileos do not need a tower on which to mount their telescopes, but instead can use a framework made of old automobile parts.

Two ambitious amateur astronomers of Los Angeles, Calif., have constructed an eleven-foot telescope with an eight-inch reflector, using the rear end of a car and an old battery for mountings and counterweights. These self-reliant back yard star gazers even ground the glass themselves for the telescope's mirror.



Young astronomers of Los Angeles, Calif., proved their ingenuity by using the parts of an old car to build a telescope. They also ground the mirror.



At the right, this car moved forward and backward and stopped in response to spoken words of command without a driver. A photo-electric cell apparatus, activated by light flashes controlled through a phone, operates it.

COLLEGE DEANS PICK TEN GREATEST ENGINEERS

WHO were the ten greatest engineers of the last twenty-five years? Deans of the engineering schools of the United States have selected:

Thomas A. Edison, Herbert Hoover, John Hays Hammond, Charles P. Steinmetz, John F. Stevens, George W. Goethals, George W. Westinghouse, Guglielmo Marconi, Henry Ford, and Ralph Modjeski.

As the five greatest engineers of all time, they chose:

James Watt, Leonardo da Vinci, Thomas A. Edison, James B. Eads, and Ferdinand de Lesseps.

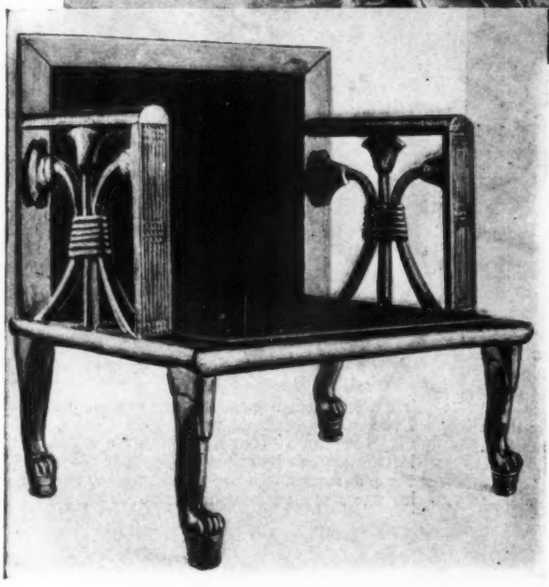
Considerable controversy was aroused recently by the publication of these lists; especially by the second. How many of these names do you recognize? Would you make the same selections?

NEW ROBOT CAR OBEYS THE HUMAN VOICE

A ROBOT car that obeys a human voice almost as readily as though a chauffeur were sitting in its front seat was demonstrated recently in New York City. In response to a series of commands spoken in a low voice into a near-by telephone, the driverless car went ahead until told to stop, backed up, stopped again, and turned on its lights when ordered to do so.

The brains of the automaton auto are lodged in a photo-electric cell apparatus activated by light flashes controlled through the telephone. Each word spoken into the telephone flashed a light source hidden in a miniature tree. Combinations of one to four flashes, through the photo-electric cell, operated relays guiding the movements of the car. The control operates only so long as the car stays near enough to the light in the tree to allow the light rays to affect the cell.

SKILL SAVES EGYPTIAN TOMB RELICS



Lieutenant Commander Wheeler at work checking the 5,000-year-old Egyptian relics. At left, a chair reclaimed from the dust of centuries.

How the gold framework and crumbling wooden furniture found in a royal Egyptian tomb were restored to their original beauty was recently told by Dows Dunham, of the Boston Museum of Fine Arts. The restoration work was the chief episode in the excavation of the tomb of Queen Hetep-heres I by Professor George Reisner, noted Egyptologist and archeologist.

At the base of a vertical shaft in solid rock, ninety feet below ground, the vault of the queen who ruled Egypt some 5,000 years ago was discovered near the little town of Gizeh, three miles from Cairo. It contained the first complete equipment of a royal burial so far unearthed. An alabaster sarcophagus, or casket; shriveled wooden furniture once encased in gold sheets; panels of wood inlaid with gold; stone and copper vessels; pottery, textiles, baskets, and other rare objects all buried in the dust of centuries were found in the midst of this decayed splendor.

The discovery raised the question of how to remove the fragile pieces from the tomb with such care that later the furniture could be restored and none of the rare articles lost. Here the painstaking methods of Professor Reisner, assisted by Lieutenant Commander Wheeler and Dunham, showed their value. He and his assistants had to work in cramped quarters. The stone vault was only about fifteen feet long, eight feet wide, and six feet high. Every square inch of the floor was covered with the mass of débris, so that it was impossible to set foot within the chamber. This obstacle was overcome by clearing away small areas until a free circle of floor space was reached. Then the real work began.

A complete and detailed record of all the parts lying hodgepodge on the floor had to be made, so that afterwards it would be possible to reassemble every piece found in the tomb exactly as it had been before removal. These records were kept by making detailed plans of the floor area and taking photographs from above, one plan for each object removed. The accomplishment of this task took 280 days and required the snapping of 1,057 photographs and the drawing of 1,701 foolscap charts.

Most of the objects on the floor were so frail and gossamery from decay that before they could be touched they had to be treated. In order to stiffen them they were coated with a celluloid solution applied by a medicine dropper, giving them a tough, artificial skin.

When the list of the relations of all the objects to each other was completed, there remained the reconstruction of the wooden furniture. The wood had either shrunk or was in a state of utter collapse. But the archeologists had a trustworthy guide to the original dimensions of the chairs and other pieces in the unshrinkable gold casings. Once the pattern weaving the different sections into a complete piece of furniture had been analyzed by the archeologists, it remained only to fit new wood to the gold cases in order to reconstruct the furniture in every detail. An example of the success of this work is shown in the photograph of the reclaimed chair which is given on this page.

CHICAGO FISH TO HAVE PALATIAL QUARTERS

MADE-TO-ORDER weather for fish, even including the healthful ultra-violet rays of sunlight, is provided at a new aquarium now nearing completion in Chicago. A refrigeration plant doing the cooling work of 450 tons of ice melted each twenty-four hours, enough to supply the ice boxes of 36,000 families with twenty-five pounds a day, will freshen the water for the inmates of this $3,000,000 aquatic home. A fleet of 125 tank cars will bring sea water from the Atlantic a thousand miles away.

Reservoirs holding a total of a million gallons are to occupy a large portion of the aquarium basement. Electric thermostatic controls will adjust the temperature of the water that streams into the 132 wall tanks modeled to line the exhibition hall on the main floor. The fish tanks will have special glass fronts, allowing the passage of ultra-violet rays. This is believed to be the first use of ultra-violet glass for this purpose. These and many other specialties of equipment are designed to wrap the fish in as luxurious a liquid atmosphere as they could get in their haunts below the waves.

Of the twenty really adequate aquariums existing in the world today, the new Shedd aquarium will be the only one not erected near salt water. It is being built on a filled-in, nearly circular peninsula extending into Lake Michigan from the shore of Grant Park, Chicago. It will be octagonal, 300 feet in diameter, with a central dome rising 100 feet over the main floor rotunda, in which is to be set a pool forty feet in diameter decorated as a semitropical swamp. Exchanges with foreign aquariums will be made, and trips to the seven seas will bring back exotic fish of all varieties.

Shedd aquarium at Chicago will have ocean water hauled 1,000 miles for its fish. Ultra-violet glass will inclose the tanks.

Let's Play a Tune

Every Nation Has Music All Its Own

Dressed in the full uniform of the Scots Guards, these experts on the bagpipe are ready to play at memorial or any other special services. The Highlander still clings to his pipes, though there are those who find them slightly less than musical.

There is no escaping the diligent ukulele player. Even in the heart of the Belgian Congo, the uke is strummed; that is, if this strange looking instrument can be called a uke. The player in the photograph is Congo's champion, and he loves to strum and sing his native African songs.

This is a bagpipe but the man is not Scotch. The pipe is now found in Italy and the bagpipers go from town to town, literally blowing their way across the land of Mussolini, earning a scant living. They have trouble in making the pipe forget the wild Scotch tunes and in training it to the softer melodies that are dear to the hearts of Italians.

This trio of Chinamen is playing what the Chinese call music. Note the long drawn out nature of the guitar, while the fiddle has fallen away to a mere nothing. Western ears are seldom pleased by what is to them far eastern "noise."

These serious minded musicians belong to the Royal Household Band of Korea. They are using instruments made in China many centuries ago. The hourglass affair at the right is a drum, capable of stirring the Korean pulse but leaving the western visitor quite calm.

This one-man band belongs to Abruzzo, Italy, where he makes merry with drum, cymbals, and the adapted Italian bagpipe, all of which he plays at the same time with hand foot, and mouth. Such musicians are popular with the children at Christmas time.

His costume is elaborate, but then he is a royal musician of Burma. The instrument, which looks like a vase, is in reality a tom-tom.

In the oval, two Russian boys are showing what can be done with the accordion, an instrument extremely popular with music loving Russians.

In a New York City public school, the mouth organ has come into its own. These boys never miss band practice and are said to produce sweet harmony.

CARVES GIGANTIC MARBLE HEAD OF GARIBALDI

ASCENDING the face of a gigantic stone head now being sculptured in Rome, Italy, would be a task for any Alpine climber. If he did manage to get a foothold on the sturdy underlip, he would never scale the bridge of the nose unless he had ropes fastened securely at the top with which to pull himself up.

The enormous head is being hewn out of marble by Professor Lapina, famous sculptor, in the image of Giuseppe Garibaldi, the Italian patriot who furthered the cause of a united Italy. When finished, the figure will be fifteen feet high and will serve as a landmark.

HUGE MACHINE TO TEST BUILDING MATERIALS

A MACHINE for testing the strength of building materials, both by tension and compression, is to be installed at Columbia University, New York. Said to be the largest of its kind in the world, the powerful machine has a pressing and pulling capacity of 3,000,000 pounds, more than equal to the weight of nine heavy-duty freight locomotives of the type used on the Santa Fe Railroad.

Specimens thirty-five feet long and six feet wide can be handled by the tester, it is claimed. A new building on Columbia campus will house the monster, which will require a two-story hall for its use. Authorities believe the machine will be able to take care of all testing jobs assigned to it.

COLOR OF GOLD DUE TO ALLOY

How can a gold watch be green, white, or yellow and still be gold? Various metals that, alloyed with gold, produce colors of artistic shades were described recently by E. A. Capillon, Attleboro, Mass., metallurgist, before the American Institute of Mining and Metallurgical Engineers.

The purity or fineness of gold is usually described in terms of "carats." Used in this way, a "carat" means a twenty-fourth part. Thus, "fourteen-carat gold" means that the metal contains ten parts of alloy to every fourteen parts of gold.

What that alloy is determines the color of the gold. Silver and copper, added to the gold in varying proportions, produce an alloy ranging in color from light greenish-white to green, yellow, or even red. Zinc is used in some green or greenish-yellow golds, and nickel and zinc together produce the bluish-white color of "white gold" now so widely used in jewelry.

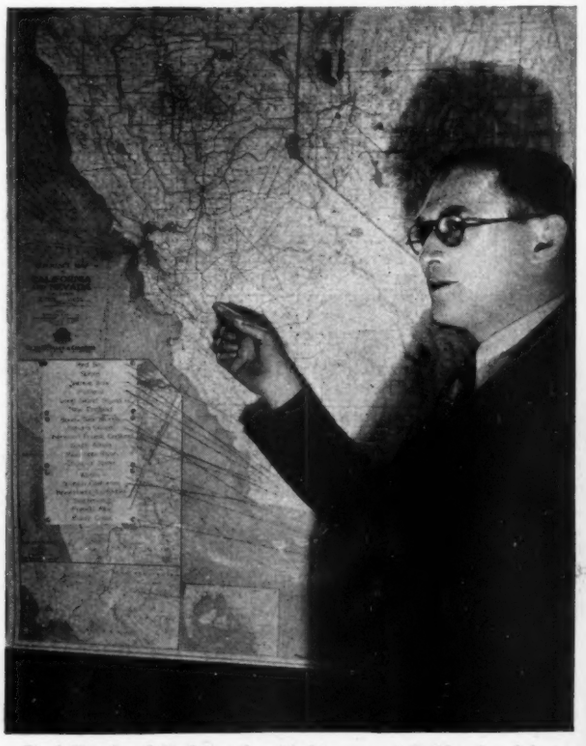
Greater cost is not the only thing that makes unalloyed gold impractical for serviceable jewelry. Pure gold (that is, of twenty-four carats) is exceedingly soft, and soon becomes covered with dents and scratches. An alloy is required to give it the hardness necessary to resist wear.

WORLD SCENES DUPLICATED IN CALIFORNIA

A DUPLICATION of nearly every picturesque spot on the globe may be found charted on a map of California which hangs in the office of Fred Harris, location manager for Hollywood motion picture companies. He claims he can show, with a few simple map pointings, why his state is the movie center of the world. Having traveled widely, Harris says that he has come to realize that California has a "double" for every unusual square mile of the globe.

The landscape of Holland, the tractless wastes of the Sahara Desert, the South Sea Islands, or the sublime peaks of Switzerland are indicated on his map. If a movie producer wants a French location like the Riviera, it is the business of Harris to find it. He merely walks to his map, looks under "Riviera," locates its California twin (the Santa Monica Palisades), and phones to the producer that he has found the place.

To get every bit of California's kaleidoscopic country on record, Harris has scouted up and down the Pacific coast for fifteen years, taking notes and photographs. He now has a catalogue of 25,000 photos on file, which he uses for reference along with the world-in-a-nutshell map.



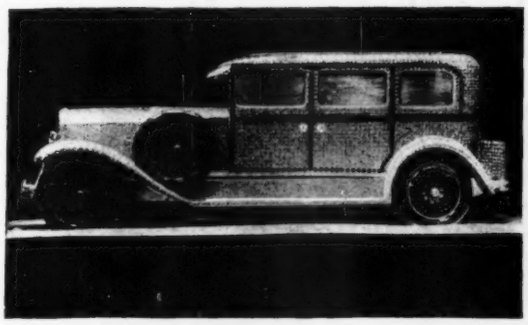
Fred Harris, of Hollywood, with his map of California, claims that he can find a "double" for any scenery in the world.

TELEPHONES TESTED WITH SOAP BUBBLES

FEW people realize that the upkeep of their telephone service depends partly on soap bubbles. Yet these are a vital element in the "gas pressure" test for detecting leaks in the sheaths of telephone cables. When a section of the long-distance cable eventually to connect New England with the South was being laid through the North Carolina woods recently, it was pumped full of gas. A man might be seen tramping from pole to pole painting the cable with soapsuds. After this coating a leak no larger than a pinhole in the heavy metal sheath of the cable would appear as an air bubble.

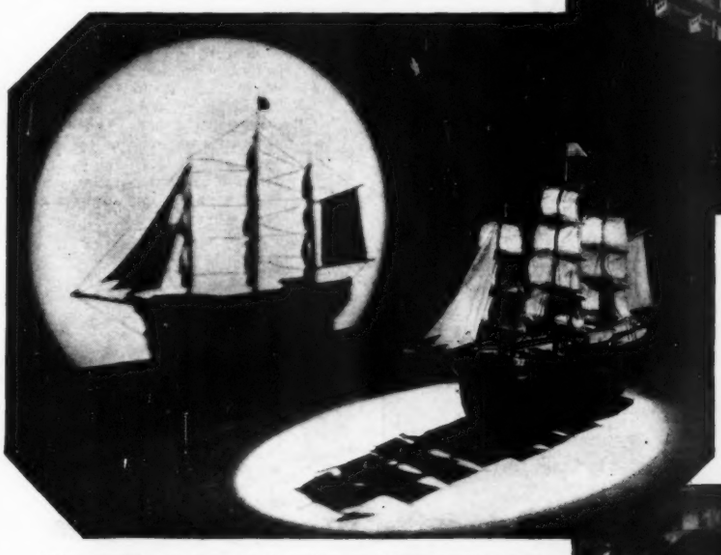
Leaks in the cable sheath must be found, as they let in moisture which, spreading to the hundreds of wires that make up the cable, eats away the paper insulation and causes short circuits and interruption of service. The gas pressure which blows the test bubbles is supplied by pumping nitrogen or carbon dioxide into the cable. Careful gage readings determine whether there is a leak. Large leaks may be revealed by a hissing sound, or detected (if carbon dioxide is used) by running a hand along the sheath, since the gas is extremely cold as it escapes.

Model Making—A Hobby and a Business



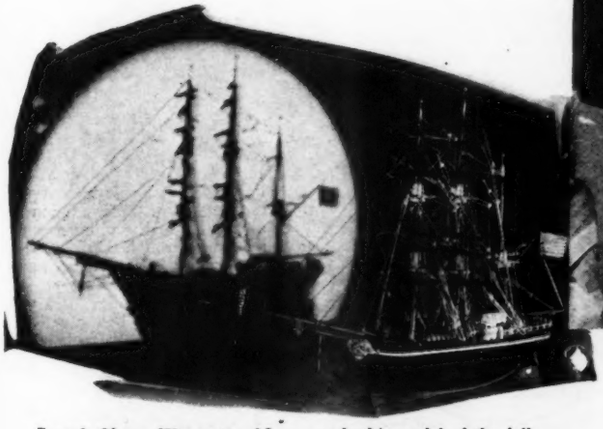
A model automobile, made by a Baltimore, Md., jeweler and exhibited at a recent auto show in that city, is priced at $100,000, which, it is claimed, makes it the most costly car in the world. Its value lies, largely, in the jewels with which it is studded. Set into it are rubies emeralds, and 3,000 diamonds with a total weight of 487 carats. The car measures six inches high and approximately two feet long.

This is not really the Cathedral of Cologne, though it looks exactly like it. The model was made by Hans Swoboda, twenty, student of architecture of Muenster, Germany, and was recently exhibited at the Grand Central Art Gallery, New York City. Six centuries were required to build the original, the foundation of which was laid in the thirteenth century. Swoboda took four years to make his model, in which are 2,500,000 matches. Without its base it is ten feet high. It is claimed to be a perfect reproduction of the cathedral, called the world's finest example of Gothic architecture.



This unusual photograph of a ship model was made by using two spot lights, the one above giving the effect of strong sunlight shining through the sails. The angle of the camera to the light source accounts for the brilliant contrasts. The model was made by Walter Marsolais, aged 14, of Worcester, Mass. He copied it from the drawing of a Norwegian barge, using a pocketknife, chisel, and file.

Two young business men of New Haven, Conn., are turning out model airplanes that bring them cash and distinction. John Lichtenberg, 16, left and Edward Fasold, 15, right, have built eight hundred planes during the past year and sold them for $500. Recently fifty-two of their models, exhibited at Yale University, won them a blue ribbon. Their output includes 250 types, ranging from those the size of a hand to real flyers with a 24-inch wing spread. At present they are making a 21-inch scale model Sikorsky.



Joseph Oberg, Worcester, Mass., made this model of the full-rigged bark *Star of Peru*. Notice the striking shadow of the boat as it appears in this remarkable photographic study.

Household Aids

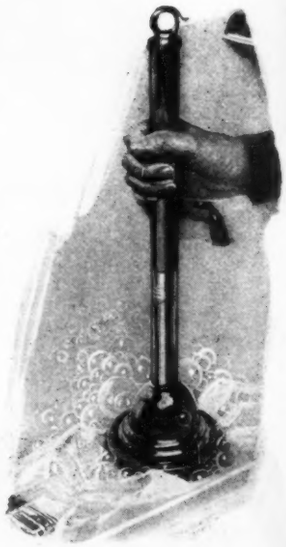
Inventions to Save You Time and Work

Want only half a slice of toast? This tiny electric toaster is designed to give you exactly that. It uses only 150 watts and is adequate for the tea table or an individual breakfast.

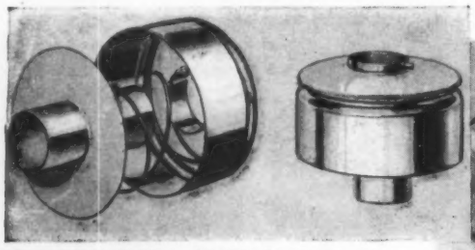
When the bird on top of this coffeepot sings, the coffee is done. If the whistle blows, it's a danger signal. Each is operated by steam in the pot. The walls of this utensil are built on the vacuum bottle principle and it is claimed that they will keep the coffee hot for more than an hour after the heat is turned off.

With a foot on the loop in the handle, this pail is held steady while dry or oiled mop is cleared of dust by turning against blades.

Full freshness is preserved in the sandwiches and vegetables that are put in this moist air compartment for refrigerators. With this it is said that both dry and moist cold can be used in the same ice box. It is especially recommended for celery, tomatoes, and watercress, to which it is said to add decided crispness.



Flimsy materials are meant to be washed with this device and escape injury. Air is admitted at the top of the plunger and is forced through the fabric as the handle is moved up and down. This is said to result in a thorough cleaning. In use, the plunger is below water.

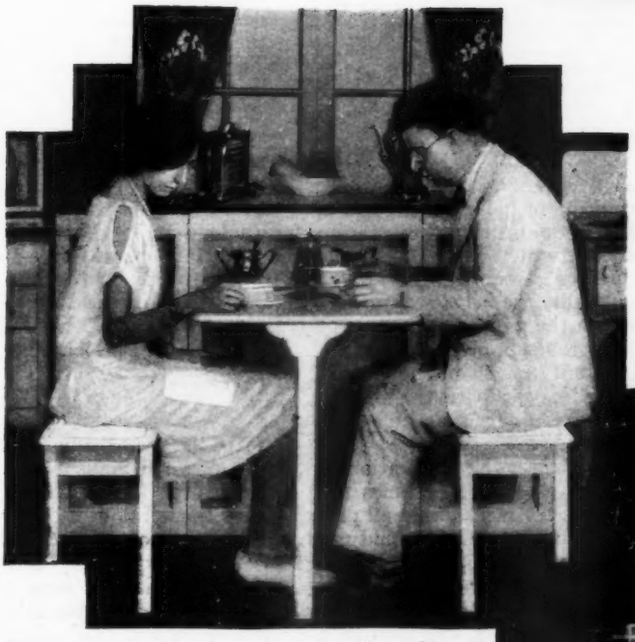


There is no sticking with this doughnut cutter, as a spring pushes the cake out when pressure is released. Biscuits or cookies can also be cut with it by removing the hole cutter and spring. At right is the container in which the device comes. It is fitted with a top and makes a perfect contrivance to sift sugar over the newly cut dough.

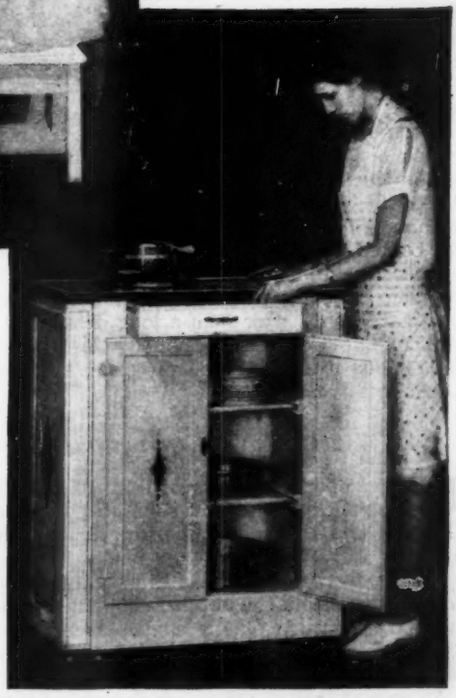
This zipper bag on the vacuum cleaner makes the task of emptying the dirt simple and easy. There are no hooks to unfasten; the clasp slides open and the dirt is emptied into a convenient pan. Then the cleaner is run for just a moment until the last particle of dust is blown out and it is then all ready for use again.

Tramps and unwelcome intruders are effectively barred by this grilled panel, which not only affords real protection but also serves as a ventilator. It is used either on the front or kitchen door. When the inner panel of this safety door is swung open the caller can be seen and spoken to without giving him an opportunity to effect an entrance into the house by force. Thus women alone in the home need have no timidity about answering calls.

An interlocking device for screen and window is said to solve the problem of screening the casement window. Both the screen and the window swing out at a touch of the handle and the curtains are thus left undisturbed.

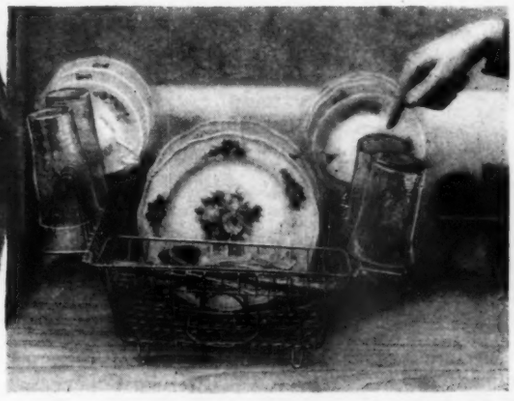


These seats and table swing out of this handy combination cabinet and at such times it provides a very convenient breakfast nook with plenty of room for two.



When this cabinet, which opens to form the breakfast nook as seen in the center photo, is closed, it forms this handy kitchen worktable in which there are also shelves for the pots and pans. Forming as it does two pieces of furniture in one, it should prove desirable in a small apartment or in homes that have an alcove breakfast room.

Cleaning a window or an automobile windshield is made easy with this little tool. The blade is faced with soft rubber, which takes up the water and leaves the glass practically dry. It is light and effective in operation and when not in use it occupies little space. and can be kept on a convenient shelf in the kitchen or garage.



Prongs on the sides of this dish drainer are designed to hold glasses so that they drain perfectly and at the same time are protected against chipping. It has a compartment for silver that swings out of the way of the china, thus reducing the possibility of breakage in handling.

Popular Science MONTHLY

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You Can Help

A PESSIMIST once defined a patent as a "license to litigate." The continual airing of patent squabbles in the papers indicates that this pessimistic designation of a patent is more than half right.

One of the principal characteristics of the human race is imitativeness. In that particular quality we betray, according to the evolutionists, our kinship with the monkey tribe.

One man invents a device which proves profitable to manufacture and immediately a host of imitators flood the market with "Chinese copies." If the device was patented by the original inventor, he is legally and morally justified in prosecuting every infringement.

The more valuable the device the greater the temptation to infringe, and the more involved and expensive becomes the resulting litigation. The inventor's task of marketing and protecting his invention is beset with difficulties. He should not be burdened further by delays and mistakes in the Patent Office which prevent him from obtaining easily and quickly a clear and valid patent. As is explained in the article on page 19, the United States Patent Office is now being operated in a manner that undoubtedly is a disgrace.

Under present conditions the inventor receives his "license to litigate" only after such a long delay that it is often of no value to him. Congress *can* remedy this situation, and Congress *will* remedy it if enough people insist. Write your Senator or Representative at once!

Revolution in Food Is Near

THE can opener, once sneered at as a badge of the ignorant and shiftless housewife, soon will become the symbol of efficiency and the most important tool in the modern home kitchen.

A few years ago the diet of the average person was restricted to fresh meat from the butcher shop and fresh vegetables from the market garden plus a small percentage of food that was preserved between seasons by drying, smoking, or other elementary means.

At present, as the article on page 44 of this issue indicates, civilization has reached the point where we practically are independent of seasons in foods. Almost any food product can be had at any time of the year, and as the article also shows, it is the equal of, or only slightly inferior to, the fresh product.

Looking into the future, it seems logical to believe that there will be continued and accelerated scientific improvement in the methods of canning foods, and with further improvements there will, inevitably, come corresponding changes in the methods of handling food. The butcher shop, for example, with its sawdust-covered floor and odor of fresh meat, may disappear and the vegetable man, with his enticing array of lettuce, carrots, and so on, may join the butcher shop in the limbo of forgotten things.

Vast stores scientifically designed to handle canned goods with the least possible expense and delay will take their places. If we judge by what has happened in other lines of human progress, it seems logical to believe that the shapes and sizes of cans will be standardized. Possibly the food store of the future will be an automatically operated slot machine.

These changes in the food available are bound greatly to influence the handling of food in the home. Perhaps the kitchen as we know it now will disappear. Certainly the conventional stove is due for a series of evolutionary steps that will adapt it specially to the handling of canned foods. The stove of the future will have an opening at the top into which the whole can is inserted and the entire operation of preparing the food, including opening the can, will be automatic.

Then the can opener, which, in the near future, will be a badge of distinction, will also go into the discard!

Limit the Narcotic Factories

ON ANOTHER page of this magazine, Dr. William I. Sirovich, a member of Congress and a recognized authority upon habit-forming drugs, tells of the appalling increase in narcotic users in this country. The hundreds of tons of opiates which are smuggled into the country annually threaten to make the United States the greatest dope-using nation in the world. The average person knows approximately 1,000 people; according to Dr. Sirovich, sixteen of these should be drug addicts.

POPULAR SCIENCE MONTHLY believes that the international agreement for the limitation of opiates, which Dr. Sirovich proposes, should be advanced with all the pressure of united public opinion. The number of factories which are flooding the world with destructive drugs must be reduced. Nations like England and Switzerland, which are profiteering in the suffering of millions of helpless drug victims in other lands. must be forced to curb the activity of their narcotic factory owners.

By exposing the alarming truth about the present drug situation, POPULAR SCIENCE MONTHLY hopes to stimulate public opinion to action against the evils of the traffic in drugs.

Exploring Comes High

FIGURING the net cash value at the present time of everything accomplished on the Byrd Antarctic expedition, it is doubtful if it more than offsets the $8,000 which was spent for forty tons of dog biscuits used on the trip.

Figuring on the same basis, the visible net cash value of Columbus' discovery of America stacked against the cost of his trip makes an even worse showing, and there have been countless other exploration trips that have cost large sums of money that gave absolutely no visible returns, and also many where explorers lost their lives into the bargain.

However, to the net accomplishments of the Byrd expedition, as detailed in the article on page 26, must be added one definite and unique accomplishment. The radio has permitted millions of people all over the world, whose daily existence is surrounded by a humdrum sameness, to enjoy in spirit the thrills of high endeavor and the daring of the actual explorers.

Doubtless the sum total of the value of this widely distributed human pleasure, in itself, more than offsets the entire cost of the expedition.

They Are Saying—

"EIGHTY-FIVE million years ago, the climate of New Jersey closely resembled that of Florida today."—Dr. Mintin A. Chrysler, Rutgers University paleobotanist.

"The violent up and down air currents caused by the high buildings of New York would, I think, make the mooring of a great airship to a skyscraper mast almost impossible at this time."—Dr. Hugo Eckener.

"The mule, finally, will be the only rival of the airplane for safe transportation in heavy fog."—Lieut. James Doolittle, fog pilot for the Guggenheim Fund experiments.

"In obtaining a domestic supply of rubber, we have a long way to go; but we are getting there."—Thomas A. Edison.

From Microphone to Your Home

ON THIS page our artist pictures every step in radio broadcasting from the studio performance to your ear.

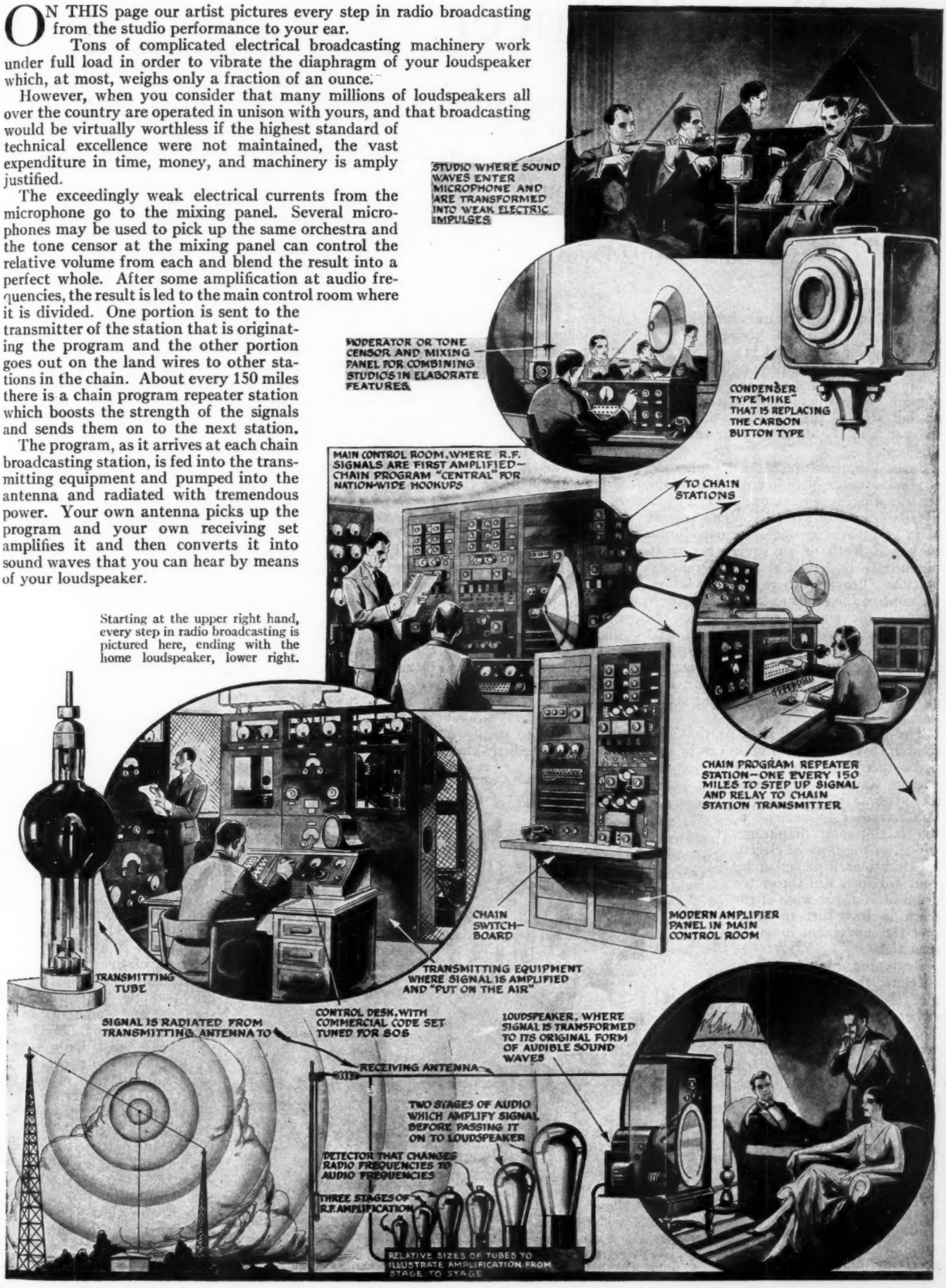
Tons of complicated electrical broadcasting machinery work under full load in order to vibrate the diaphragm of your loudspeaker which, at most, weighs only a fraction of an ounce.

However, when you consider that many millions of loudspeakers all over the country are operated in unison with yours, and that broadcasting would be virtually worthless if the highest standard of technical excellence were not maintained, the vast expenditure in time, money, and machinery is amply justified.

The exceedingly weak electrical currents from the microphone go to the mixing panel. Several microphones may be used to pick up the same orchestra and the tone censor at the mixing panel can control the relative volume from each and blend the result into a perfect whole. After some amplification at audio frequencies, the result is led to the main control room where it is divided. One portion is sent to the transmitter of the station that is originating the program and the other portion goes out on the land wires to other stations in the chain. About every 150 miles there is a chain program repeater station which boosts the strength of the signals and sends them on to the next station.

The program, as it arrives at each chain broadcasting station, is fed into the transmitting equipment and pumped into the antenna and radiated with tremendous power. Your own antenna picks up the program and your own receiving set amplifies it and then converts it into sound waves that you can hear by means of your loudspeaker.

Starting at the upper right hand, every step in radio broadcasting is pictured here, ending with the home loudspeaker, lower right.


STUDIO WHERE SOUND WAVES ENTER MICROPHONE AND ARE TRANSFORMED INTO WEAK ELECTRIC IMPULSES
MODERATOR OR TONE CENSOR AND MIXING PANEL FOR COMBINING STUDIOS IN ELABORATE FEATURES
CONDENSER TYPE "MIKE" THAT IS REPLACING THE CARBON BUTTON TYPE
MAIN CONTROL ROOM, WHERE R.F. SIGNALS ARE FIRST AMPLIFIED—CHAIN PROGRAM "CENTRAL" FOR NATION-WIDE HOOKUPS
TO CHAIN STATIONS
CHAIN PROGRAM REPEATER STATION—ONE EVERY 150 MILES TO STEP UP SIGNAL AND RELAY TO CHAIN STATION TRANSMITTER
CHAIN SWITCH-BOARD
MODERN AMPLIFIER PANEL IN MAIN CONTROL ROOM
TRANSMITTING TUBE
TRANSMITTING EQUIPMENT WHERE SIGNAL IS AMPLIFIED AND "PUT ON THE AIR"
SIGNAL IS RADIATED FROM TRANSMITTING ANTENNA TO
CONTROL DESK, WITH COMMERCIAL CODE SET TUNED FOR SOS
LOUDSPEAKER, WHERE SIGNAL IS TRANSFORMED TO ITS ORIGINAL FORM OF AUDIBLE SOUND WAVES
RECEIVING ANTENNA
TWO STAGES OF AUDIO WHICH AMPLIFY SIGNAL BEFORE PASSING IT ON TO LOUDSPEAKER
DETECTOR THAT CHANGES RADIO FREQUENCIES TO AUDIO FREQUENCIES
THREE STAGES OF R.F. AMPLIFICATION
RELATIVE SIZES OF TUBES TO ILLUSTRATE AMPLIFICATION FROM STAGE TO STAGE

Why Your Radio May Sound Queer

Distortion may occur at many points in the electrical circuit between antenna and your ear, especially in the audio stages or loudspeaker.

By ALFRED P. LANE

YOU can hear music and human speech by radio because of the working of a fixed law of Nature. A physical object can be in only one place at any one particular time. The diaphragm of the microphone in the broadcasting studio, the cone of your loudspeaker, and the drum of your ear obey this law.

Several musical instruments may be producing notes of different pitch in the broadcasting studio at one time, but as the diaphragm of the microphone cannot be in two places at once, it must vibrate back and forth in an irregular way in response to the effect of the different vibrations. Provided there is no distortion, the cone of the loudspeaker repeats these irregular movements and thus sets the air in your room into pulsations that move the drum of your ear in corresponding irregular movements. These irregular movements are separated, by the nerves of the ear, into the various sound sensations.

The real marvel of radio is that this complicated, irregular motion can be carried so perfectly through the various stages of your radio set. The slightest change in this irregular movement of the microphone diaphragm which, in the form of electrical vibrations, is picked up by your antenna, will throw the drum of your ear wide of the mark in its effort to interpret the movement in sound sensations.

Beginning at your radio antenna, there is, for example, the effect of static—either natural or man-made. This causes distortion by combining with, and therefore changing, the electrical impulses. Your ear interprets these changes as crackling, grinding, or sizzling noises although, of course, no such noises actually exist in the air.

As the radio waves, plus whatever alteration are made by static, is passed along through the radio-frequency amplifier stages of the radio receiving outfit, two serious forms of distortion may be introduced.

The broadcast wave, as it is received by your antenna, is spread over a band of electrical frequencies. Too sharp tuning will cut down the strength of the frequencies near both edges of the band and the radio waves will be distorted by the loss of some of the little wiggles that represent the high notes. A piccolo will be reduced to a squeak and the higher violin notes will lose their distinctiveness.

THE other serious distortion which may be introduced in the radio-frequency stages is cross modulation. This term means that the electrical wave you are trying to receive may become scrambled with the wave from some other station, with the result that there may be either slight distortion or complete hash.

The detector tube in the set, which takes the radio waves and by rectification gets them back to electrical frequencies that can be converted into sound, may introduce several kinds of distortion.

If it fails to rectify uniformly, it lops off some of the little kinks which represent the high notes. It may even introduce a few kinks of its own which will make the music sound a bit queer. If it is overloaded with too heavy a signal from the radio-frequency stages, rectification will be incomplete and the announcer will sound as though he were gargling instead of talking.

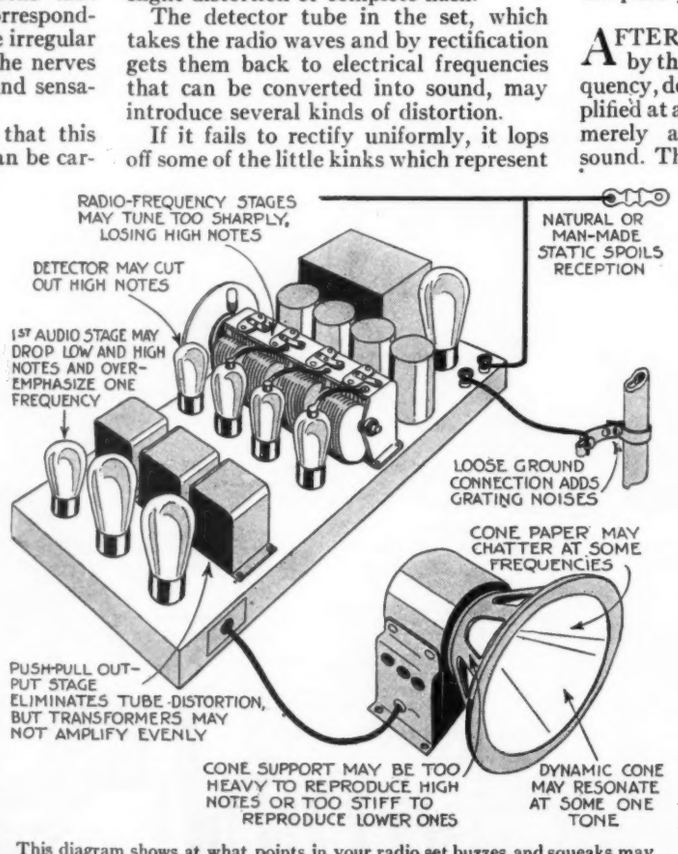
However, all the distortion that may be introduced by the detector tube and what goes before it is a mere trifle to what can happen after the electrical impulse leaves the detector and starts through the audio amplifier.

Leaving the detector tube, it must go through the first audio transformer which may mangle it almost beyond recognition. Both the sharp little kinks of the high notes and the easy broad motions of the low notes in the radio waves may be flattened out. Also the transformer may, in addition, display marked partiality for kinks of a particular size and therefore amplify them out of all proportion to the rest of the signal. To your ear, the result will be the complete loss of the bass drums and bass viol at one end of the musical scale and at the other the loss of all the higher overtones that make it possible to distinguish one instrument from another. This overemphasis of one frequency may result in a disagreeable shriek whenever a musical instrument in the studio sounds a note approaching that frequency.

The distortions introduced in the first audio stage may be made even worse in the second, or power, stage if the transformers are not up to the mark. Of course if the power stage employs two power tubes in the push-pull circuit, slight distortions introduced by the tubes themselves will be eliminated automatically by the push-pull arrangement.

AFTER the signal has been brought in by the antenna, amplified at radio frequency, detected (rectified), and again amplified at audio frequencies, it still remains merely an electrical equivalent of the sound. The next step is to convert it into vibrations in the air which will affect the eardrum and produce the sensation of sound. This operation is accomplished by the loudspeaker. This is a critical step in the whole process. The electrical impulses are first converted into mechanical motion electromagnetically and then this mechanical motion is changed to air motion by the cone of the speaker.

Many forms of distortion are possible in the loudspeaker, and some of them are quite common. Mechanical parts must have some weight and consequently some natural rate of vibration. In constructing the moving parts of loudspeakers, the makers attempt to get the moving parts so light that the natural rate of vibration is faster than any audible sound, but often it is not possible to do this. The loudspeaker may, therefore, introduce distortion by reënforcing some particular tone.


RADIO-FREQUENCY STAGES MAY TUNE TOO SHARPLY, LOSING HIGH NOTES
NATURAL OR MAN-MADE STATIC SPOILS RECEPTION
DETECTOR MAY CUT OUT HIGH NOTES
1ST AUDIO STAGE MAY DROP LOW AND HIGH NOTES AND OVER-EMPHASIZE ONE FREQUENCY
LOOSE GROUND CONNECTION ADDS GRATING NOISES
CONE PAPER MAY CHATTER AT SOME FREQUENCIES
PUSH-PULL OUTPUT STAGE ELIMINATES TUBE-DISTORTION, BUT TRANSFORMERS MAY NOT AMPLIFY EVENLY
CONE SUPPORT MAY BE TOO HEAVY TO REPRODUCE HIGH NOTES OR TOO STIFF TO REPRODUCE LOWER ONES
DYNAMIC CONE MAY RESONATE AT SOME ONE TONE

This diagram shows at what points in your radio set buzzes and squeaks may get into the reception. Much of this annoyance can come from the audio stage or it may start with the antenna and end only with a rattle in loudspeaker.

HELPFUL HINTS FOR RADIO FANS

Hook-up to Use Direct Current

B Batteries Can Be Eliminated Unless Set Has High Voltage Power Tube—How to Locate Trouble

WHILE eventually alternating current will be universally used in this country for home lighting and the operation of home electrical appliances, there still remain many areas in some of the larger cities where direct current is supplied for use in the household.

In such locations, the radio set owner is definitely handicapped at present because nearly all commercially built radio sets are designed to operate on 110-volt alternating current. Connecting such a set to a direct current circuit would result in blowing the fuses or burning out the primary of the power transformer in the radio receiver.

Large numbers of radio set owners in such districts are still using battery operated radio receivers without making any attempt to take advantage of the possibilities of the direct current that is available.

In most districts supplied with direct current, the power is brought in from the street on three wires. One of these wires is at ground voltage. Another is at 110 volts above the ground voltage. The third is at 110 volts below the ground voltage, so that between either of the two live wires and the central or neutral wire there is a voltage of 110; and because of the polarity 220 volts are available between the two live wires.

Ordinarily, only two wires are led into the various apartments, the load being divided in the building between both sides of the line. This means that although 220 volts D. C. may be available in the basement, only 110 volts D. C. are available in any particular apartment.

If you happen to be living in an apartment supplied in this way, you can at least get rid of the B batteries by constructing a simple D. C. B-eliminator. The circuit is shown on this page. The required material consists of a board on which to fasten the instruments, an ordinary porcelain fuse block, a drop cord and plug, one B-eliminator filter choke, two two-mfd. filter condensers of not less than 200 volts working rating, one variable resistance having a range of 500 to 5,000,000 ohms, and one one-mfd. filter condenser with 200-volt rating.

This apparatus, together with three binding posts and a few pieces of insulated wire for making connections, will supply you with a satisfactory D. C. B-eliminator that will have a constant output of ninety volts. The difference in the output and input, of course, is caused by the resistance of the filter choke. This type of B-eliminator will take care of any battery operated set except one fitted with power tubes that require high voltage. If such a set is to be operated from the B-eliminator, the 171A tube can be removed and a 112A tube substituted.

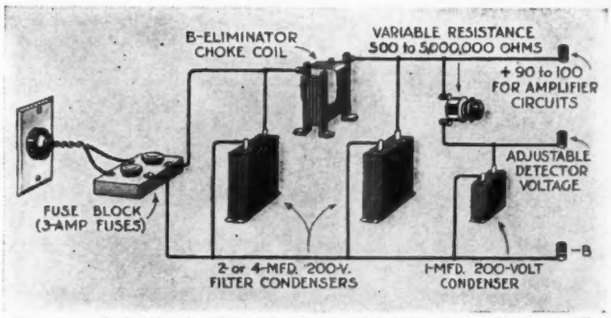

B-ELIMINATOR CHOKE COIL
VARIABLE RESISTANCE 500 to 5,000,000 OHMS
+90 to 100 FOR AMPLIFIER CIRCUITS
ADJUSTABLE DETECTOR VOLTAGE
FUSE BLOCK (3-AMP FUSES)
-B
2 or 4-MFD. 200-V. FILTER CONDENSERS
1-MFD. 200-VOLT CONDENSER

Diagram of circuit showing a hook-up with direct current that will eliminate B batteries, operate at a low cost, and produce 200 volts.

One point must not be neglected, and that is the fitting of a one-mfd. filter condenser in the ground lead to the radio set. The wire from the ground binding post to the set should be connected to one terminal of the filter condenser and the other terminal of the filter condenser should be connected to the water pipe or whatever other ground may be used. This condenser is absolutely necessary to prevent possible chances of a short circuit. You may be located on the side of the power line where the live wire is minus. This means that the third or neutral wire actually supplies the positive current to your radio set, and the live wire which normally would be grounded cannot be connected directly to the water pipe by way of the wiring in the radio set. The condenser will stop the flow of direct current and permit the flow of the radio-frequency current which operates through the antenna circuit. It is not necessary to make any elaborate tests to determine the polarity. Connect the B-eliminator circuit to the proper binding posts on the set and insert the wall plug. If the set operates, the polarity is right. If it does not, reverse the wall plug in the socket and then mark it in some manner so that you can always replace it correctly.

If you are so located that both sides of the three-wire system are available, exactly the same circuit can be used and you will have an ideal D. C. supply, at extremely low cost, capable of producing at least 200 volts and consequently sufficiently powerful to operate the 171A tube at maximum volume. Exactly the same circuit should be used and the same precaution taken with regard to the condenser in the ground lead. However, if the circuit is to be operated on 220 volts D. C., it is desirable to step up the rated working voltage of the condenser to not less than 300.

A B C's of Radio

MANY radio beginners are confused as to the actual advantage of push-pull audio amplification. Aside from greater power handling ability of the push-pull circuit, it has one definite advantage in improved tone quality. It is almost impossible to arrange a circuit so that the electrical oscillations representing sound may be fed into the grid circuit of a single tube and be amplified without distortion in the plate or output circuit of the tube.

Using two tubes in push-pull eliminates this inherent tube distortion. Provided the tubes are reasonably well matched, the push-pull circuit balances the distortion produced in one tube against the distortion produced in the other so that the two forms of distortion always oppose and cancel each other.

As for power-handling ability, any two power tubes in a push-pull circuit have an output theoretically twice, and practically nearly thrice, that of one of the tubes used in a conventional circuit.

Locating Queer Noises

EVERY object has a vibration rate. In other words it will vibrate back and forth very easily at some definite number of times a second. In your home, near your loudspeaker, are many objects each of which has some natural rate of vibration. When the loudspeaker sounds a musical note with a vibration rate that is the same as that of some near-by object, the object will have a tendency to vibrate. If it happens to be supported in such a way that it is free to follow the air vibrations, it will begin to oscillate back and forth and in doing so will strike against some supporting object. The result will be a chattering noise that will spoil the music. Before you blame the loudspeaker for chattering noises, be sure to investigate all near-by ornaments.

As the cars whizzed over the top of the hill and swept past Gus, Hank was several car lengths ahead of Jack.

Tricks That Add to a Car's Speed

Gus Bets on a Sure Thing Because He Knows Automobiles and Human Nature—Then He Explains

By MARTIN BUNN

JOE CLARK stepped out of his little office, slammed the door, and walked disgustedly back to the rear of the Model Garage where Gus Wilson, his partner in the auto business, was working.

"Something's just got to be done about it, Gus," he complained. "Hank Witherbee and that young Jack Landrith 've been wrangling with each other in the office till I'm nearly crazy. Go in and shoo 'em out for me, will you?"

"Shoo 'em yourself. I've got troubles of my own," the veteran auto mechanic growled as he "miked" a new piston pin and found it way out of round.

"Another one of them darn 'eggs,'" he grated, snapping the offending pin into the scrap pile under the bench. "What're they arguing about, anyhow?"

"Same old thing," Joe replied. "Each one claims his car is faster and better on hills than the other fellow's."

Gus reached for a clean piece of waste and headed for the office.

Young Landrith was pounding on the desk in his excitement as Gus strode into the office. "Is that so!" he shouted. "You know darn well that my car can beat yours anytime, anywhere. Every time we've had a brush I've licked you!"

"G'wan," Hank scoffed. "I didn't even know you were racing me."

"You fellows have exactly the same car," Joe interrupted. "What's the sense of arguing that way when both cars have the same speed?"

"They haven't anything of the kind," put in Gus emphatically. "Jack, you think your car is faster. I'll bet you twenty bucks Hank can beat you on a hill or on the level."

"You're on!" Jack snapped angrily. "Just give me a chance and I'll find good use for that twenty."

"All right," said Gus, "Joe and I'll meet you fellows at the foot of Shonk's Mountain at six tomorrow morning when there won't be any traffic. You can race up the mountain and then try out again on that level piece this side of it. How about it Hank?"

"I'm willing," Hank agreed.

"Don't forget to bring the twenty with you," Jack called as he left the Garage.

"What makes you so sure Hank will win?" Joe asked after the two had gone.

"Well, I know Hank and I know Jack," smiled Gus mysteriously.

"I'm glad it's your twenty you're risking," Joe grunted.

It so happens that the road beyond the stiff grade up Shonk's Mountain curves away at a gentle slope so that a person standing at the top can see the road for nearly two miles. Also the top of the hill is visible from the bottom. Consequently Gus, by waving, could signal the contestants when the road was clear.

The two cars had drawn up side by side at the foot of the hill and as Gus waved, they started with a roar. For about a quarter of a mile they stuck together like a team of horses, and then Hank began to pull ahead so that as they whizzed over the top of the hill, and swept past Gus, he was several car lengths ahead.

The result was the same on the level road race.

"Here's your twenty," said Jack as he fished out a twenty-dollar bill and looked at it dolefully as he offered it to Gus. "He beat me fair enough," he added, "but I'm blamed if I see how he did it. I can drive just as well as he does."

Gus pocketed the money. "Come back to the garage with us," he said, "and I'll tell you how he beat you."

"Now," said Gus, when they were all in Joe's little office. *(Continued on page 140)*

GUS SAYS—

WHAT'S the use of barking your knuckles, cussing around, and taking three or four times as long to do a job just to save the price of a couple of special tools? One spavined monkey wrench and a dull screw driver may do for some would-be auto mechanics, but the fellow that knows what he's about gets a good set of spanner wrenches, a socket wrench set, and special tools when they're needed.

POPULAR SCIENCE HOME WORKSHOP

Articles on Furniture, Models, Toys, Sporting Equipment, and All Forms of Craft Work—Better Shop Methods—The Shipshape Home

The covered wagon—symbol of the "great westward tide" which swept American civilization across the continent.

Westward Ho!

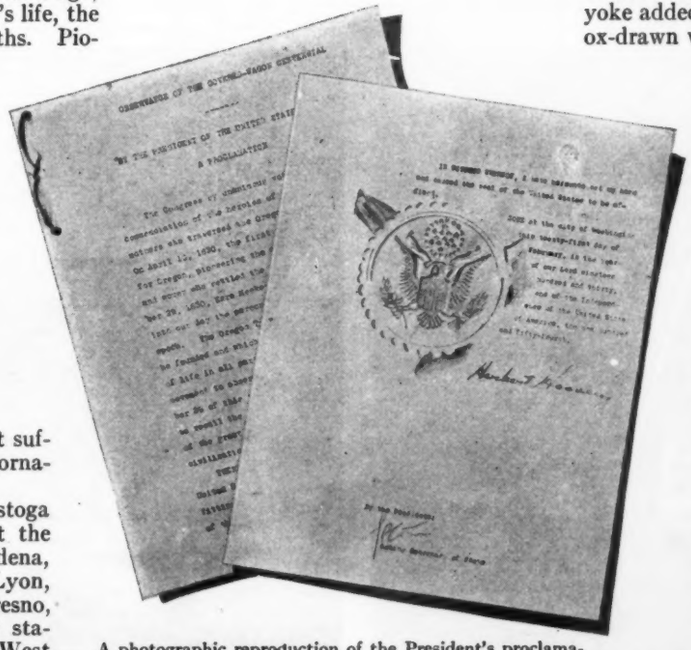
A Covered Wagon Model

By EDWIN M. LOVE

FROM Atlantic to Pacific seaboard—a trifling matter of two days by rail and air; yet a short while ago, within the span of a man's life, the journey was reckoned in months. Pioneering families forsook the comfort of eastern farms for a perilous life in rough wagons, drawn at a snail's pace by oxen, bulls, mules, horses—yes, at times, by men. Theirs was the incredible toil of blazing a trail over trackless prairies and range after range of craggy, forbidding mountains.

When the writer set out to find a covered wagon to reproduce in miniature for the readers of POPULAR SCIENCE MONTHLY, he looked for one that was typical of its time, yet sufficiently well designed to be ornamental as well.

A suitable wagon of the Conestoga type was at last discovered at the Pony Express Museum in Pasadena, Calif., owned by W. Parker Lyon, millionaire ex-mayor of Fresno, Calif. The wagon is fittingly stationed among relics of the old West—ox yokes and chains, hand printing presses, a coach once driven by Buffalo Bill, and hand-drawn fire engines.



A photographic reproduction of the President's proclamation setting aside the period of April 10 to December 29, 1930, as the Covered Wagon Centennial. On April 10, 1830, the first covered wagons left St. Louis for Oregon and on December 29, 1830, Ezra Meeker, the pioneer, was born.

Equipped with brakes, doubletree, and singletrees, it is typical of the mule-drawn covered wagon; with these omitted and a yoke added, it may properly represent an ox-drawn wagon.

Full size drawings are essential in building a model such as this. Blueprints have therefore been prepared with all the necessary details drawn full size; these can be obtained by sending seventy-five cents for POPULAR SCIENCE BLUEPRINTS Nos. 118, 119, and 120 (see page 110).

Use close-grained hardwood such as maple or birch; and for metal parts, where soldering is unnecessary, use aluminum. If sheet aluminum is not easily obtainable, use a cookie sheet for No. 16 gage, and a thin aluminum pie tin for the No. 28. The ⅛ in. thick No. 22 gage stock is easily made by hammering the cookie sheet material. These utensils can be purchased at any ten-cent store.

REAR WHEELS. *Felloes:* Scribe the inner and outer felloe circles on a flat board, dividing them into seven equal parts by stepping

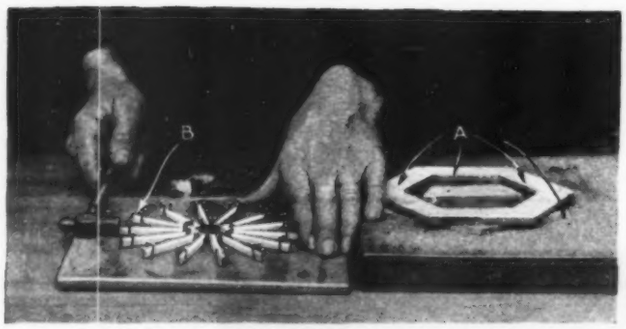


Fig. 1. Six felloe segments *A* are used for each layer in the front wheels, and seven are used in the rear. The spokes are placed, driven in until they are flush with the felloe circle, and held with brads *B*.

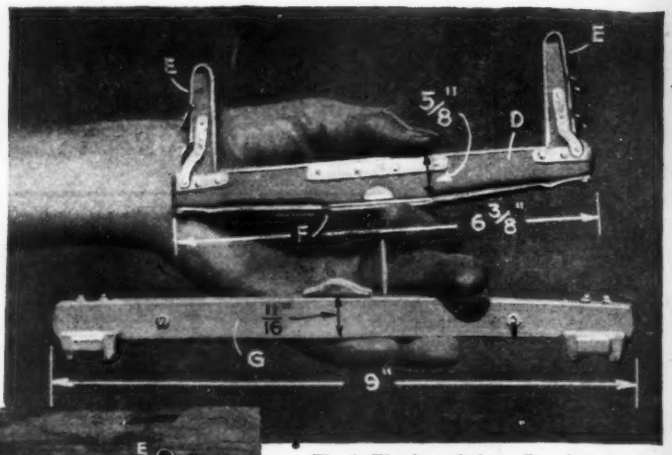


Fig. 2. The front bolster *D* and the brake beam *G*. The stakes *E* are all the same size.

around with dividers. Halve these divisions and draw the radii. Cut fourteen equal segments *A* from 3/16-in. stock made from rough 1-in. material. Nail seven together on the board with brads, covering the felloe outlines, and glue the other seven on top, staggering the joints (see Fig. 1). By all means use a waterproof glue—preferably casein glue, which has the necessary strength. When dry, scribe circles and cut along the outlines with a jig saw.

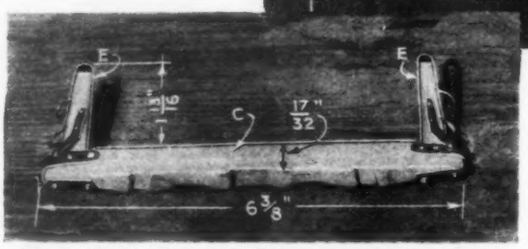


Fig. 3. The rear bolster *C*. The underportion is notched to receive the reach *U* and the hind hounds *H* (see Fig. 9).

Dress to 3/8-in. dimensions—an operation which can be done in a few seconds with a sanding disk—and round the inner corners to 1/16-in. radius.

Spokes: Twenty-eight spokes cut 2 7/8 in. long, 3/16-in. wide, and tapering from 5/16 to 1/4 in. in thickness, are scraped and filed to an oval section from the ends to within 1/4 in. of the butts, leaving flats on the faces 1/4 in. outside the hub. Sand them smooth.

To assemble the spokes, make a form *B*, driving four brads for each spoke (Fig. 1). Taper the butts, coat them with glue, and place loosely, afterwards driving the spokes up to the felloe line with light blows on the ends and then adding the fifth brad. Put a cardboard disk 1/16 in. thick under the butts before placing the spokes; and when they are assembled, force on the felloe. If the spokes do not all bear tightly against it, wedge them out with blocks driven into the wheel center. The lower or outer faces of the spokes lie flat, there being no dish.

Hubs: Turn the hubs and groove them 5/16 in. for the spokes, cutting in deeply; make the inner faces of the back sections a little concave. Remove from the lathe and cut off the waste end from a front section. Bore a 3/16 in. deep hole with a 1/2-in. bit, bore through the front section with a 1/4-in. bit, and saw off. Bore the rear inside section with a 5/16-in. bit. When the spoke assembly is dry, glue the hub in place, and nail. Also nail the felloe to the spokes. Fill the hub spaces between the spokes with a plastic wood composition.

Ironing: Measure the tire length with a piece of paper around the felloe, allowing 3/8 in. for the lap. Cut a strip of aluminum 1/2 in. wide, file bevels on the ends for scarfs, and rivet together with two short pieces of aluminum put through No. 50 holes. Bevel the inner edge on one side, and drive the tire over the felloe. File to width, and drive in the escutcheon-pin tire bolts.

The spoke hub bands are butted at the joint and held with brads through No. 60 holes. The flat bands are scarfed, bound with wire, and soldered.

FRONT WHEELS: Use twelve spokes and felloe sections, and when assembling the spokes put enough cardboard shims under the butts to dish the wheels 1/8 in. at the felloes.

BOLTS AND NUTS: Center-punch and drill metal of the right thickness, trim and file to 1/8 in. square, and place the nuts by driving brads through the holes. Round carriage-bolt heads are simulated with short escutcheon pins.

CLIPS: Hammer radio bus wire flat, leaving round legs to go through the yokes.

BOLSTERS. *Front (D):* Shape the wood first in the square, and round the lower corners of the tapered ends. Note

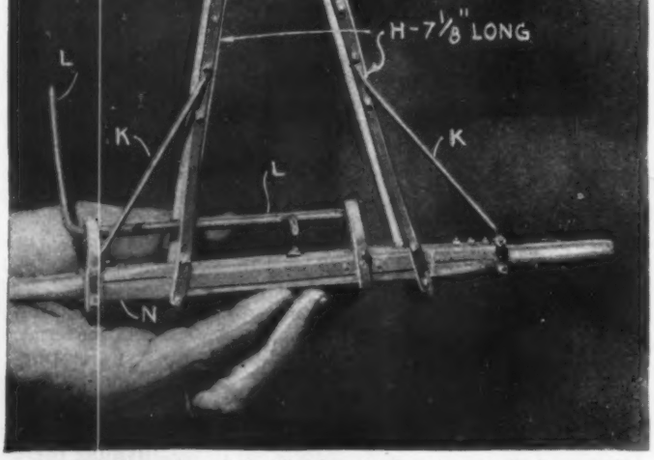


Fig. 4. Bottom view of the hind hounds *H* and rear axle *N* assembly. The rear bolster *C* is not shown, since it is entirely hidden by the axle *N*.

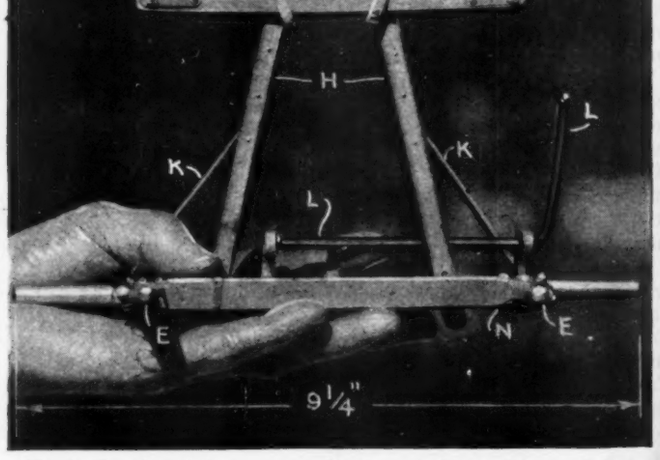


Fig. 5. Top view of the same assembly shown in Fig. 4. The rear bolster and stakes *E* show, but all except the spindles on the axle *N* are hidden.

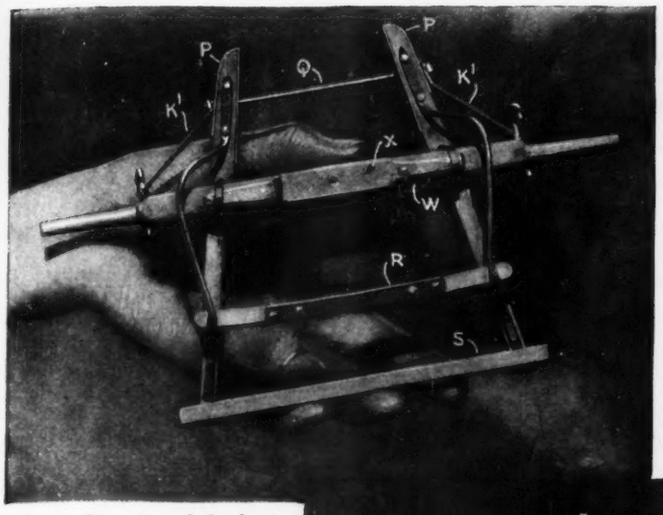


Fig. 6. Top view of the front hounds *P* assembly showing sand board *W* and sand plate *X*.

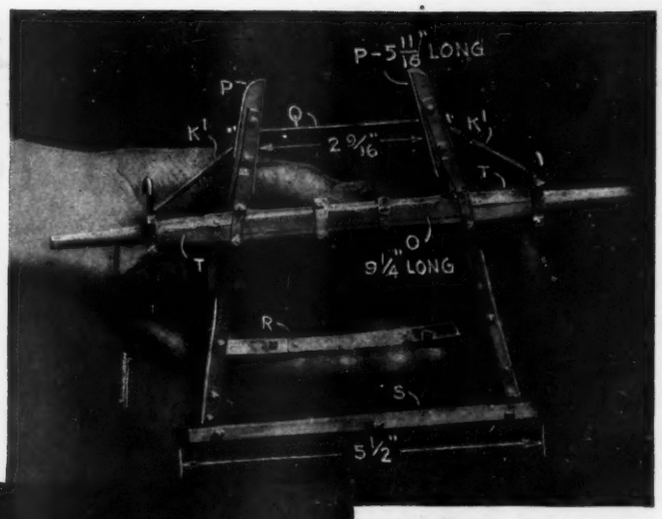


Fig. 7. Bottom view of the same assembly shown in Fig. 6. The bottom of front axle *O* is shown.

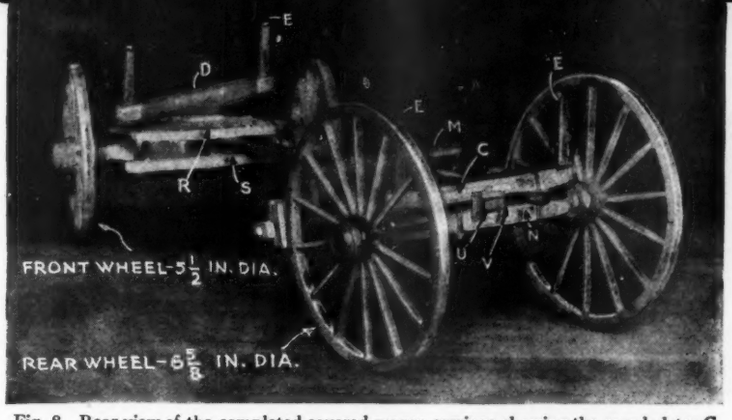


Fig. 8. Rear view of the completed covered wagon carriage showing the rear bolster *C* and rear axle *N* assembly, the end of the reach *U*, and the cardboard reach socket *V*.

the extra thickness of the sand plate *F* in the center. Carve a dowel on the lower end of each stake *E* to fit holes in the bolsters, and cut ring notches. Attach the binding irons with short brads (see Fig. 2).

Rear: There is no sand plate. The reach socket is cardboard colored with aluminum paint (see Figs. 3 and 8).

SAND BOARD: Designated by *W* in Figs. 6 and 9. Make a cardboard pattern. Note rounded parts, sand plate, and hound notches.

AXLETREES: The spindles are solid with the axletree. Square them, rasp off the corners, scrape round, and finish with sandpaper.

Cut the skein blanks (skeins shown in place at *T* in Figs. 7 and 9) from No. 28-gage aluminum, using paper patterns, and shape them on the axle, nailing the underedges. Light taps with a small hammer will round the ends to fit the tapers.

Shape the metal thimbles which fit on the axle spindles when in place; cut a little off the ends so that, when driven up, they will come tight. Keep them on with end plates secured with bolts. The plate is clasped by two clips whose legs rivet the nuts.

HOUNDS. *Hind (H):* Glue and brad together at the forward ends with the spacer block *I* between. Bolt on the binding plate and upper iron, and add to the underside the reach iron *J*. Notch above and below for the bolster and axle, and glue and nail these in place. Make irons as shown in Figs. 4, 5, and 9.

Front (P): Butt the end crosspieces and nail, making the tenon ends with a plastic wood composition. Notice the crosspiece *S* and fifth wheel *R* (see Figs. 6, 7, and 9), and the wooden beads between sand board *W* and axle *O*.

REACH: Designated by *U* in Fig. 9. It has a tapering metal strap beneath. Use No. 18 escutcheon pins for bolt heads on the upper side.

BRAKE. *Beam:* The shoe and clevis bearing castings are hardwood, painted with aluminum paint and secured with brads. See *G* in Figs. 2 and 9.

Rod: Fold brass for the clevises. Snip V-notches in the folds to enter the notches in the rod ends, and solder. See *Y* in Fig. 9.

Lever: The short throw lever shown in Figs. 4, 5, and 9 is bound in place with wire before soldering. Be sure that the joint is clean before applying the wire binding, flux, and solder.

Those readers who wish to simplify their model may omit the brake mechanism, substituting a length of cheap watch chain hooked to the box side. The practice was to loop the chain around a rear wheel felloe so that the wheel would slide downhill.

In an article to follow in the July issue, Mr. Love will tell how to complete this covered wagon model.

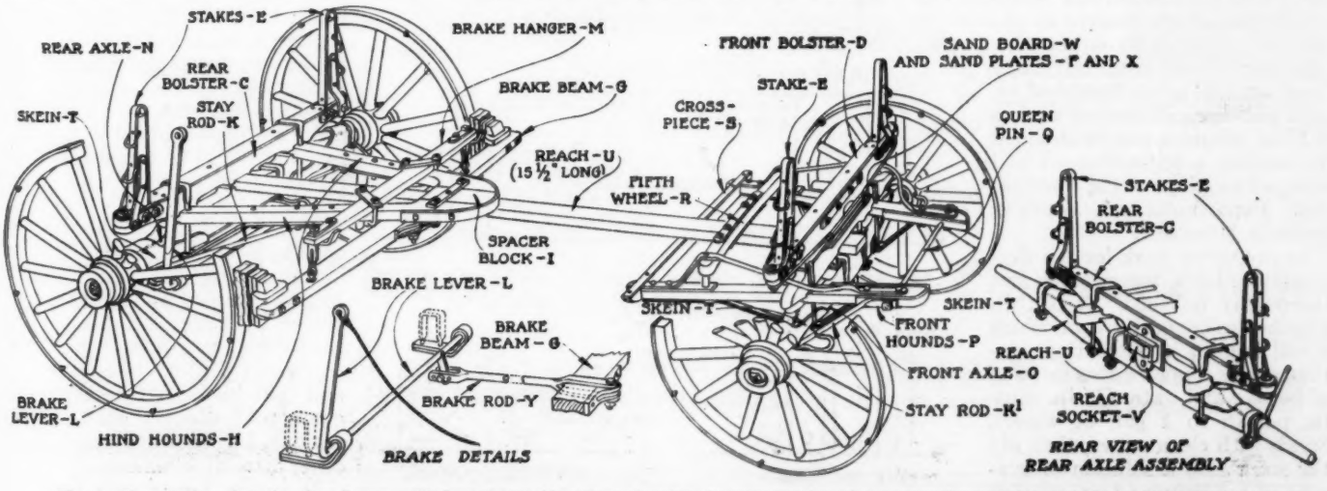


Fig. 9. Perspective view showing the assembled carriage. Also views showing the construction of the rear axle assembly and the brake mechanism. Full size plans for construction of this model can be obtained by sending seventy-five cents for Blueprints Nos. 118, 119, and 120 (see page 110).

Electroplating— An Aid to the Craftsman

How the Home Worker Can Apply Special Finishes to Metals—Preparing Various Types of Work—What Solutions to Use

By EDWARD THATCHER

Simple electroplating can be done right at the metal working bench.

HAVE you ever been at a loss to know just how to fasten a copper fitting in place when all that you had were brass and iron screws? A knowledge of electroplating in its simpler form would have given you the answer to this question and to many others of a similar nature.

For small work, the outfit needed is inexpensive, and the work will prove to be extremely interesting. Simple glass or porcelain bowls may be used as plating tanks, and copper wire for the connections (see Fig. 2). Since direct current is needed in the process of electroplating, dry cells can be used.

It is best to purchase the solutions in the concentrated form and add distilled water to them to get the desired volume rather than attempt to make them yourself. The various plating solutions can be obtained from dealers in platers' or jewelers' supplies in either concentrated or salt form, full directions usually being furnished on each package. Names of dealers in these solutions can be obtained by sending a self-addressed and stamped envelope to the Information Department of POPULAR SCIENCE MONTHLY.

In preparing work for the electroplating bath, the metal is first thoroughly polished. It is then attached to copper wire, on which it will be hung in the plating solution, and is dipped into a solution of hot lye and water (½ lb. caustic potash to 1 gal. of water). Scrub with clean water, then dip the work into a solution of cyanide of potassium (2 oz. cyanide to 1 gal. of water) to remove all oxide, and scrub again with water. Do not touch the work with the hands after the cleaning operation has been started.

Figure 1 shows the arrangement using dry cells as the current source. The current flows from the positive (+) pole (the center terminal on a dry cell) along the wire in the direction of the arrows to the metal to be deposited, which is called the anode. This is hung in one side of the plating tank in the plating solution. From the anode the current flows through the plating solution to the work being plated, which is called the cathode.

The current in passing from the anode to the cathode causes the metal of the anode to go into solution and forces the metal of the plating solution to be deposited on the cathode or piece of work being plated. From the cathode the current flows through the wire to the negative pole of the battery, thus completing the circuit.

The plating bath is always made up of the metal to be deposited, together with other chemicals to assist in the electrochemical reaction. Thus for copper plating, we use a pure copper anode and a copper solution; for silver plating, a silver solution and a silver anode, and so on for each metal. All solutions should be kept entirely separate from each other.

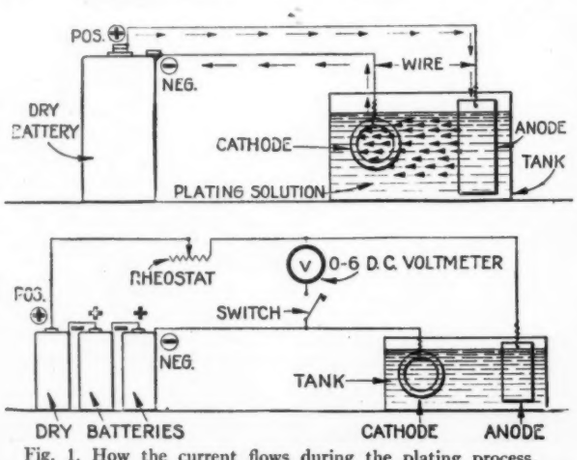


Fig. 1. How the current flows during the plating process. A simple three-dry-cell hook-up for use in the small shop.

The various metals to be deposited require different voltages. Copper requires from 3 to 3½ volts; nickel, from 3 to 4 volts; gold, from 3 to 5 volts; silver, from ½ to 1½ volts; and platinum, from 1 to 1½ volts.

This voltage regulation is extremely important even for the simplest form of plating. Too high a voltage will cause a dark, hard, brittle deposit. A good arrangement for the home shop is shown at the bottom of Fig. 1. This, however, is for very small jobs only. Three dry cells are connected in series, and a 30-ohm rheostat is connected in the positive (+) line to the anode. A 6-volt D.C. voltmeter may be connected with a switch across the line between the rheostat and the anode to supply a means of determining the proper voltages.

FOR large objects and for quantity work, especially wound direct current dynamos are used, which supply a voltage of 10 volts and a current of about 200 amperes. The size of the work in the tank governs the amount of current to be used. A 6-volt automobile generator is satisfactory for the small shop if the current is suitably regulated with rheostats. Commercial installations generally have two rheostats, one at the generator and one at the plating tank.

The anode used should always be of slightly larger area than the work. Sometimes several anodes are hung about the work. Cast anodes of pure metal are used commercially for copper and nickel plating, but metal in the sheet form may be used as anodes for small baths.

A great deal of external coloring on jewelry is done by plating. For instance, "rose gold" finishes may be given to gold by plating it in a copper bath for a short time and then rubbing or polishing off the copper in places. Special baths and anodes are furnished for green gold, Roman gold, rose or antique, English bright, and many other attractive finishes.

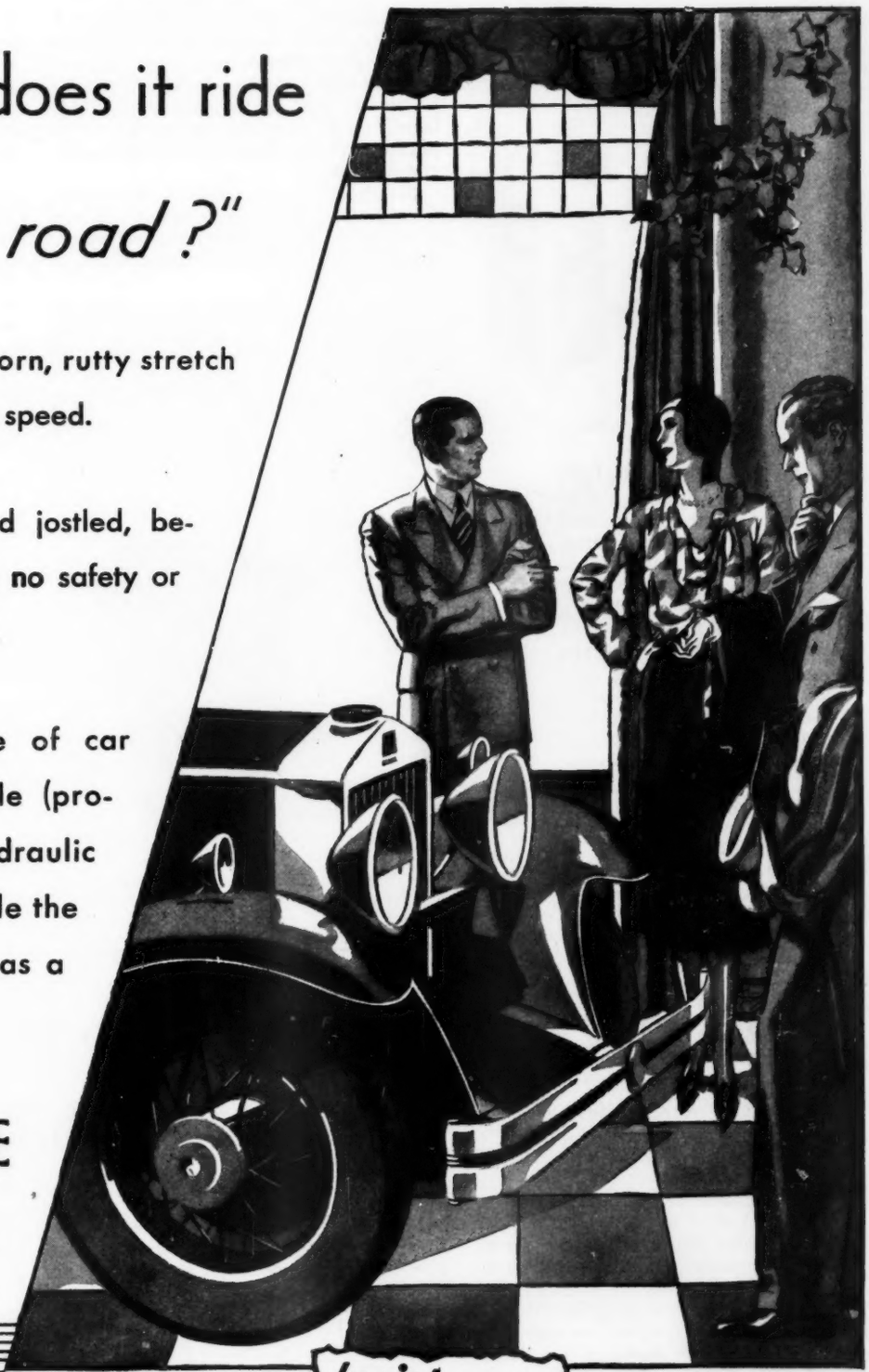
If a very heavy coat is to be deposited on the metal, the work

..."but how does it ride on a *rough road?*"

Charge into a badly torn, rutty stretch of road without slackening speed.

If you are bounced and jostled, beware .... there can be no safety or comfort in a bouncing car.

Remember, *any* make of car equipped with Houdaille (pronounced Hoo-Dye) Hydraulic Shock Absorbers will ride the worst bumps as gently as a gull on a rolling sea.



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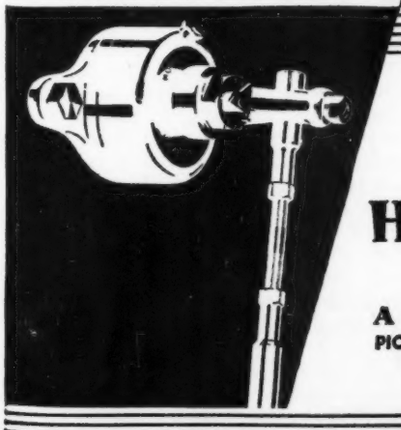

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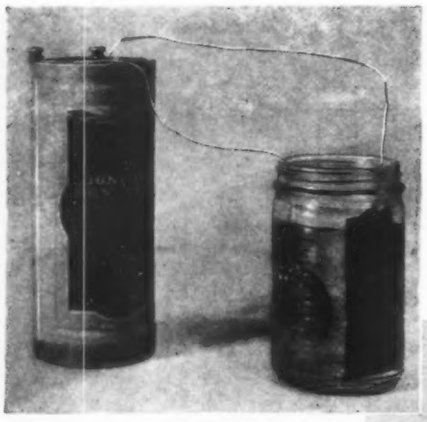


Fig. 2. Glass or porcelain jars can be used as plating tanks.

is usually removed from the bath several times and lightly scratch-brushed to lay the metal, and then cleaned with lye, water, and cyanide before it is replaced in the bath.

Old plating is removed by a process called "stripping," which usually consists in dipping the work into a very strong acid pickle. When the old plating has been eaten off, the work is cleaned as previously suggested before it is placed in the plating bath.

The work is washed with clean water after plating and dried in boxwood or other sawdust.

To remove lacquer from a piece of work, place the metal in a hot solution of lye. After the lacquer is removed, wash the piece in water and dip it in cyanide solution before plating.

It must be understood that all work to be plated must be very thoroughly polished and all scratches removed, because plating will not hide any unevenness in the surface.

Some plating baths have to be heated. Copper and gold solutions are heated to about 180 degrees Fahrenheit before using. Silver and nickel solutions, however, are used cold. A small bath may be heated in a good quality white enamel kitchen utensil which has a perfect coat of enamel with no breaks in it. This utensil is, of course, not to be used for anything else, as practically all plating baths are made up of a strong solution of cyanide of potassium, which is exceedingly poisonous.

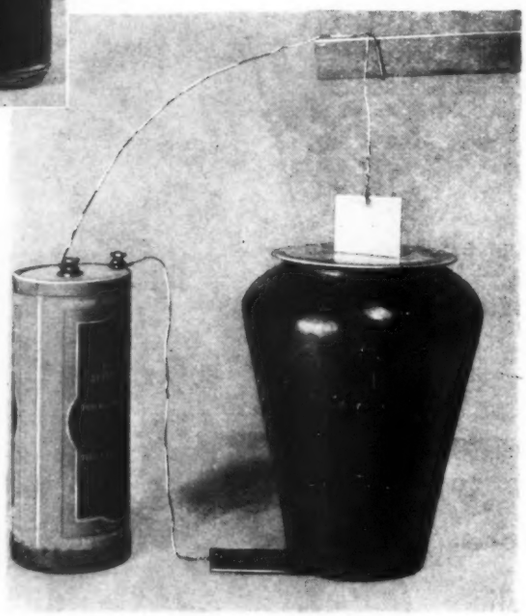


Fig. 3. The inside of a vase can be plated by using the vase itself as a plating tank in the manner illustrated above.

Do not under any circumstances get your hands in the plating solution; wear rubber gloves as a protection. Since the work is suspended on copper wires, it may be entirely handled by these. The only danger in handling cyanide solutions is the very remote possibility of getting it in the mouth or in the slightest cut on the hands or the body. Extreme caution on the part of the worker, however, will eliminate any danger.

Platers sometimes use what is called a "striking bath," which is a special plating bath used with a slightly higher voltage. This is used for a short time before the regular bath in order to start a firm metal deposit.

Iron and steel are usually first copper plated before nickel plating.

Figure 3 shows how the inside of a metal vase may be plated by using the vase itself as a plating tank. A plate of copper placed under the vase furnishes the negative connection to the current source. Dams made of beeswax may be built about the irregular tops of such pieces to confine the solution.

In his next article, which is scheduled for early publication, Mr. Thatcher will tell how to make spoons, ladles, and tea strainers from sheet metal.

Door Catches and How to Install Them

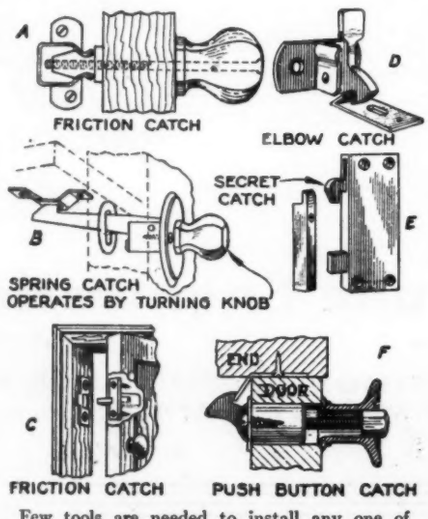
FEW home workers realize to what extent the shelves of any well-stocked hardware store hold the solutions to apparently difficult problems. For example, the fastening of a closet or cupboard door often is accomplished by using a clumsy and more or less complicated or unsightly lock, catch, or bolt. This is not at all necessary when catches such as those illustrated may be obtained and installed with comparative ease.

The friction catch shown at *A* is an excellent one for the single door of a bookcase or cabinet. It may be easily installed; and a slight push will close the door, while a gentle pull will open it. The spring striker of the catch may be fastened to the inside of the end of the case, if the door shuts over the ends, or to the door jamb if it is a closet door.

The spring catch illustrated at *B* operates by turning a knob. The catch may be placed on either side of the door jamb or frame, or on the top or bottom of a shelf. This catch will work equally well upon a large or small door, upon a single door closing over the ends, or on each of a pair of double doors so that either can be opened independently of the other.

In its various sizes, the friction catch illustrated at *C* may be used on almost any door. It will help prevent and cure warping and rattling; and even if the door shrinks quite badly, the latch will still perform efficiently. It may be fitted so that it will not show on the face of the work.

Illustrated at *D* is one of the best known devices for holding a standing door—the elbow catch. It does not show from the outside and it may be placed either above or below a middle shelf. It also may be placed at either top or bottom of a door, or at both places, in which case the door is more likely to be held straight. This type of catch can be released only by opening the other door, hence it is to be preferred if the case is to be locked.



Few tools are needed to install any one of these six useful types of closet door catches.

The secret latch, illustrated at *E*, is invisible from the face side when the door is closed. The door may be closed by pushing lightly on it, or opened by pushing harder, which releases the catch. The latch case may be either fitted into the wood or screwed to the surface of the door. These catches may be used for either right- or left-hand doors and are not affected by shrinking and swelling unless the door binds. If the door is to be used from both sides, a knob or handle may be placed on the back.

At *F* is shown the push-button type of catch. These can be installed on bookcases, china closets, or kitchen closets. The latch is operated merely by pushing the button.—DAVID WEBSTER.

WHEN grass or weeds spring up between sections of concrete walks or other crevices, they can be killed by sprinkling salt on the cracks or by applying any oil such as kerosene or gasoline.

"We always recommend RCA Radiotrons"

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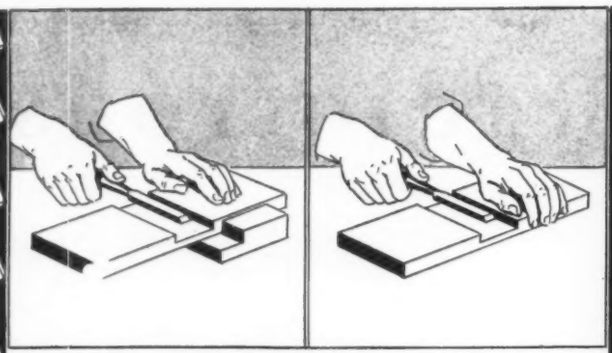
THE HEART OF YOUR RADIO SET

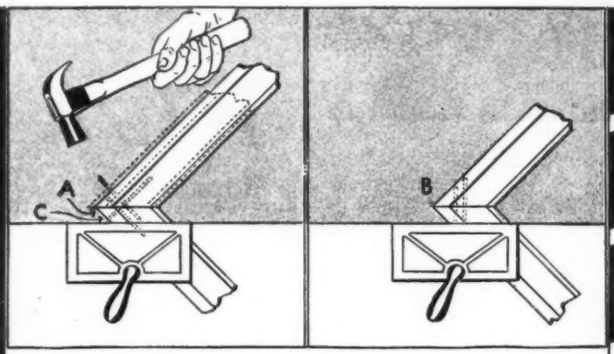
IS This seal on an advertisement in POPULAR SCIENCE MONTHLY signifies the approval of the INSTITUTE OF STANDARDS. See page 8.

Better Ways of Woodworking

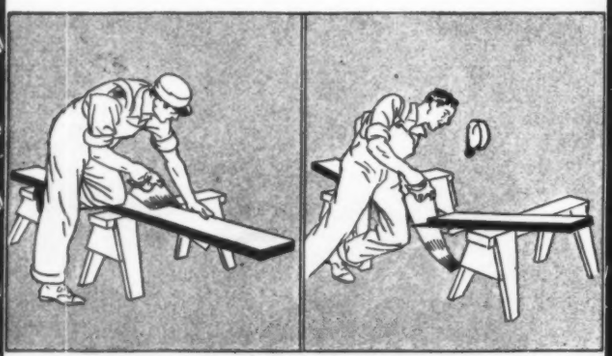
In a Series of Twelve Graphic Sketches, CHARLES A. KING Shows the Beginner How He May Improve His Craftsmanship



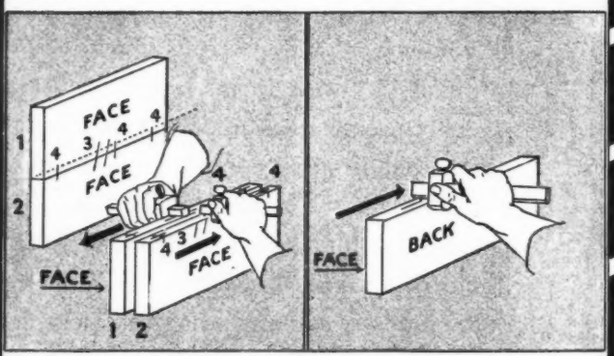
If a chisel is used correctly and the work is held firmly on a bench hook, there is little danger of making a miscut. The left hand should be kept back of the cutting edge in the manner shown above at the left. The direction of the cutting force should be away from the left hand. If the wood is held as indicated at the right with only the unaided hand to steady it on the bench, it is quite likely that the work will be spoiled or the left hand perhaps badly cut through a slip of the chisel.



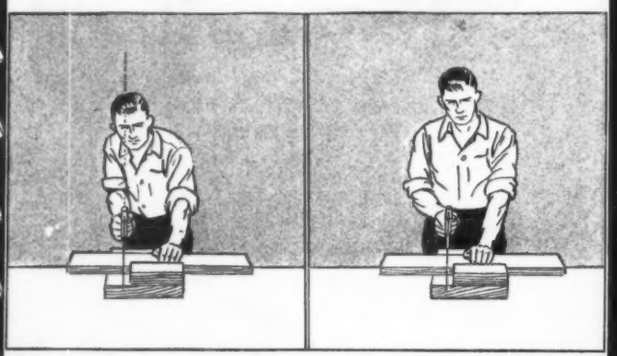
The correct way to nail a miter is shown at the left. Place the upper piece so that it overlaps the under piece about ⅛ in. as shown at *A*. Drill nail holes in the top-piece; then, as the nails are driven into the second piece, the upper piece will slide into place. The common error is to drive the nails in the manner shown at the right at *B*. This forces the pieces apart instead of drawing them together. Additional nails are often driven as at *C* in the left-hand sketch for added strength.



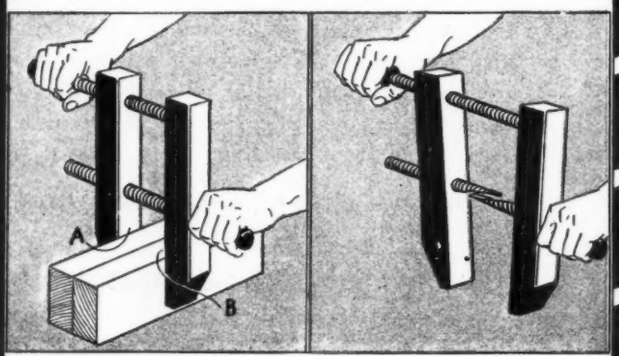
In sawing boards, support the stock as shown above at the left and not as sketched at the right. Rest the longer end of the stock on two horses and support the free end with the left hand as shown. To make a practice of the wrong method of sawing illustrated at the right will be expensive from the standpoint of ruined lumber. If an extremely large piece is to be sawed, it will sometimes be necessary to support the free end on a third sawhorse in order to eliminate the tendency to break or split.



A gage should be used from the front face in the manner shown above at the left and never from the back face as at the right. Note in the left-hand sketch that the face sides of pieces 1 and 2 are indicated by two marks at 3. When piece 1 is laid over to mark the edge after the dowels have been located by marks 4, we find the dowel centers by using the gage from the face side in each case. If piece No. 1 is gaged from the back, any error made in setting the gage or in measurement will be multiplied.



How to use a saw and a bench hook is shown at the left. The center of the saw blade, arm, elbow, shoulder, and eye should all be in one vertical plane. The back should be bent just enough to bring the elbow in the same horizontal plane in which the saw cuts. Swing the arm with an even motion, and the force will be applied in such a way as to keep the cut square, straight, and accurate. This, however, would not be the case if the almost upright posture shown at the right were used.



In manipulating a hand screw, grasp the middle screw with the left hand and the end screw with the right in the manner shown above at the left. Open and close the screw by turning the hand screw over and over, being sure that the jaws are kept parallel at all times. The middle screw should draw the jaws together until they press against the sides of the work as shown at *A* and *B*. Neglect to keep the jaws parallel, especially when left under strain, results in the condition shown at the right.

3 Reasons for Oil Burner LEADERSHIP

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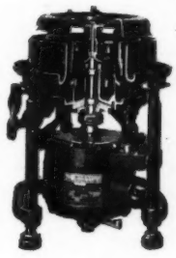
This diagram illustrates the extreme simplicity of the Silent Automatic mechanism, and shows the reasons for its remarkable dependability. Note that there is only one moving section.



2 - True Gaseous Flame

Note the character of the Silent Automatic flame—blue with a yellow tip. A true gaseous flame, product of scientific combustion.

3 - Wiping Wall-Flame

The famous Silent Automatic Wiping *Wall-Flame* sweeps away the insulating layer of gas—the principal resistance to the flow of heat in ordinary systems.

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THE NOISELESS OIL BURNER

(275)

This seal on an advertisement in POPULAR SCIENCE MONTHLY signifies the approval of the INSTITUTE OF STANDARDS. See page ^.

Kinks Helpful to Car Owners

Work behind instrument panel made easy with small mirror. Cutout is used to operate spare tail-light.

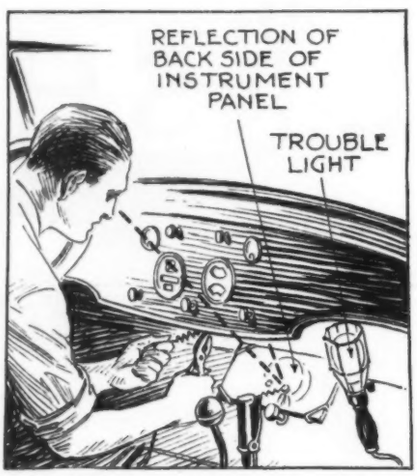

Fig. 1. Mirror can be used as shown when repair work is being done on dash instruments.

ALMOST the most awkward place around a car to do work is back of the instrument panel. Repairing the wiring of some of the dash instruments can be done quite easily with the aid of a mirror placed as shown in Fig. 1. Any convenient small mirror will do. Support it so that it will reflect to your eyes the image of the parts on which you want to work while you are comfortably seated in the front seat. Place a trouble light where it will illuminate the work.

Simple Ice Carrier

FIGURE 2 shows how to make an ice carrier from sheet iron about 3/16 inches thick. Bend it so that it fits over the edge of the running board, then drill straight through for a bolt which can be held in place with a wing nut. The two projections are formed with the aid of a cold chisel. If long pieces of ice are to be carried, it will be well to make two of the devices, spaced at the proper distances on the edge of the running board.

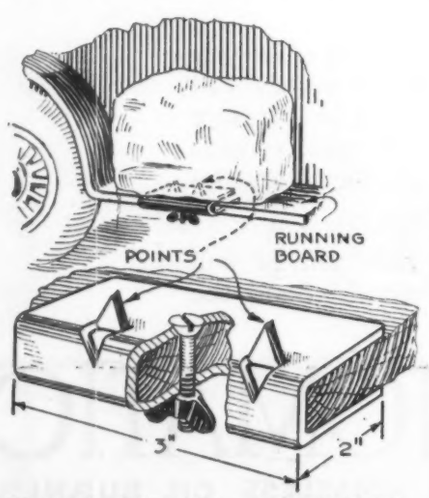

Fig. 2. Sheet iron, bent over running board and bolted down, makes a good ice carrier.

Foiling the Parts Thief

ANY device, such as a bumper, ordinarily can be removed by a thief equipped with a monkey wrench. However, few accessory thieves will attempt to remove anything that appears to be riveted to the frame or body of the car. You can fool the accessory thief by the method shown in Fig. 3, if the material is molded over the boltheads and nuts so as to resemble large rivets. After it is dry it should be painted to match the color of the surrounding metal parts.

Spare Tail-Light

UNLESS the tail-light is wired in series with the dash light and three-volt bulbs

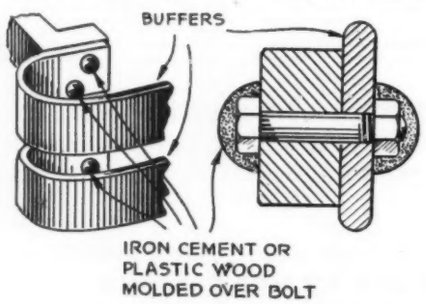

Fig. 3. Thieves are deceived if bolts are covered with iron cement and painted over.

are used at both points, the motorist has no way of knowing whether the tail-light is burning. Fig. 4 shows a way to wire a generator cutout and a spare tail-light so that the extra tail-light will light at once when the regular tail light bulb

POPULAR SCIENCE MONTHLY awards each month a prize of $10, in addition to regular space rates, for the best idea sent in for motorists. This month's prize goes to Frank Curtis, Forest Hills, Ill., for his suggestion for a remedy for a defective tail-light circuit (shown in Figure 4, at upper right, and described in column two).

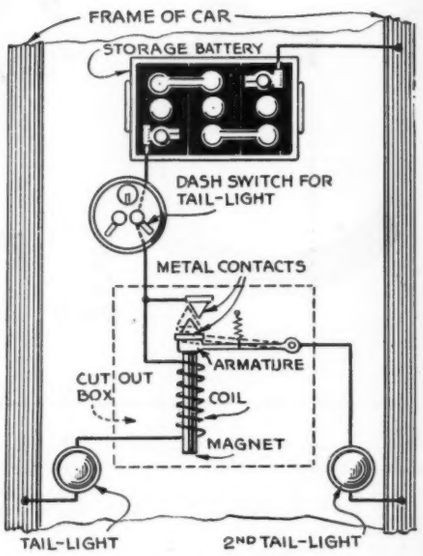

Fig. 4. Spare tail-light is wired to old generator cutout so that it will work automatically.

burns out. As soon as a new bulb is placed in the regular tail-light, the spare will automatically go out. As the diagram shows, current flowing through the cutout magnet winding by way of the regular tail-light keeps the circuit open, through which current can reach the spare tail-light. When the regular tail-light burns out, current stops flowing through the magnet and the circuit through the spare automatically closes.

Novel Valve Lifter

AN OLD hammer handle, part of a door hasp, two bolts and nuts, a piece of wire, and a curtain ring can be made into a satisfactory valve lifter as shown in Fig. 5. The ring is slipped over a cylinder-head bolt. Be sure to use strong wire.

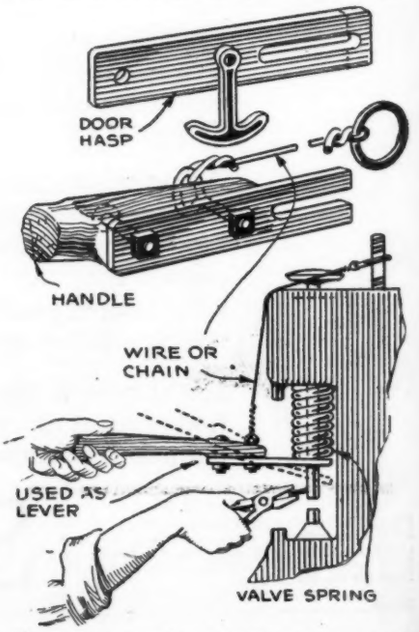

Fig. 5. Easy to make a valve lifter at home with hammer handle, bolts, ring, and bit of wire.

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Mobiloil Prize Winners
An Ounce of Prevention
Operating Precautions
The Outboard Motor
Outboard Motor Troubles
Diesel Engines
Surface Ignition Oil Engines
Navigation and Equipment Information

What every motorboat owner should know

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when it lacks power?
when it goes dead?

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Making Joints with a Groover

How to Use This Timesaving Addition to the Small Motor-Driven Circular Saw in Constructing an Attractive Combination Rose Trellis and Garden Gate

By WILLIAM W. KLENKE

The trellis can be used in conjunction with a stone or brick wall or a wooden garden fence.

OUR story on the operation of portable woodworking machines for the home workshop would not be complete without some mention of that important circular saw attachment, the groover.

Groover cutters are used in much the same manner as a circular saw. The cutter is made up of two heavy combination saw blades, or rip saws with rather large teeth, and a series of fillers. The two saws make the cuts on either side, and the filler blades chisel out the wood that is between. The width of the cut is regulated simply by varying the number of filler blades that are inserted.

The groover has the advantage of making, in one cut, a large number and variety of different width grooves, doing the work all in one operation instead of in four or five separate cuts. Grooves may be cut across or with the grain or at any angle. The groover also may be used for cutting accurate rabbets.

In place of the usual mortise and tenon type construction, it is often easier, quicker, and almost as good to make an end or slip-on mortise and tenon joint. The mortise of the joint can be cut with a groover and the tenons with a circular saw blade (Figs. 2, 3, and 4). For the construction of drawers, too, you will find the groover cutter a substantial timesaver.

When you insert the different cutters, be careful to shift them (Fig. 1) so as not to have all the cuts in one place, which would result in a rather choppy cut. See that you have the throat of the saw table fitting quite closely to the blade; this can be easily and quickly accomplished by placing a piece of flat board over the opening and then raising the saw so that it cuts its own opening. Clamp this board down to prevent motion. It is always dangerous to work with an open or wide throat, as there is a possibility that the wood will slip into the machine.

In Figs. 2, 3, 4, and 5 are shown a number of safety cuts for both the groover and circular saw. You will note in Fig. 4 that a block is clamped against the ripping fence when the cutting-off guide is used. As the wood passes by the saw, it is free on the fence side. Accidents may occur if your wood binds; but simply by clamping a block in place, this source of danger is entirely eliminated.

I have chosen a rose trellis and gateway for this article, since it is a timely subject and lends itself well to the various home workshop machine operations. Use white pine, cypress, fir or other wood suitable for outdoor construction.

CONSTRUCTING THE TRELLIS. Lay out one of the segments with a pair of trammel points or with a cord having a pencil fastened at one end and a nail at the other (see Fig. 6). Be sure that the grain on each segment runs the long way to give strength. The joints are broken—that is, the segments are not placed evenly but are placed as bricks are laid. One segment on each side must be cut to a flat end to connect with the upright pieces. Cut these segments on the band saw. The posts are worked from 3 by 4 in. stock dressed on all sides.

If there is no masonry work on which to fasten the trellis, set the posts, preferably chestnut, into the ground with their ends 3 ft. below the surface. Cut the curved top of the trellis before setting the posts in

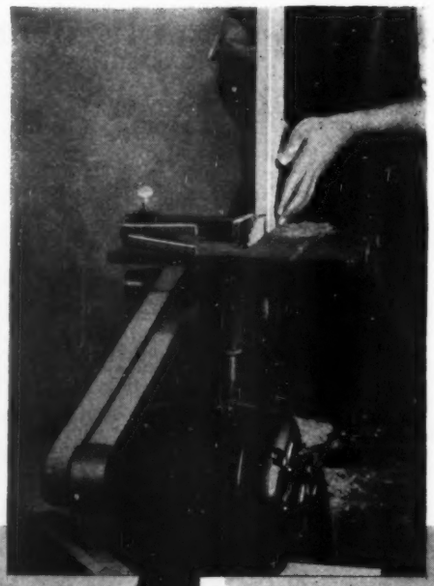

Fig. 1. Arranging the fillers in a cutter. If possible, place blades at right angles to each other.

Fig. 2 (upper photograph). The hands must be held on the sides and not directly behind the cut.

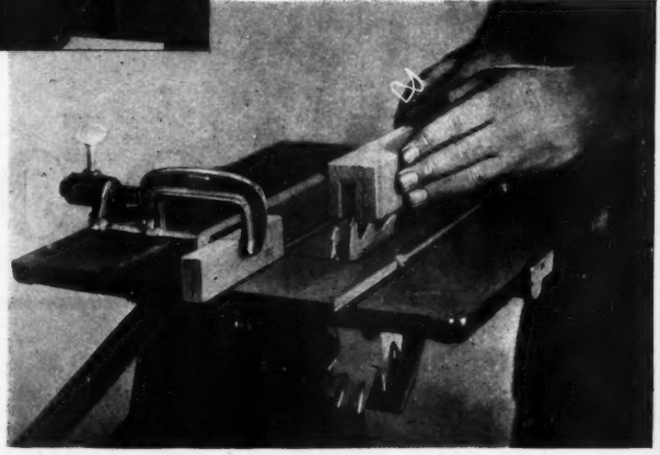

Fig. 3. The groover used to cut a slip-on end mortise. Note the stop block clamped in place.

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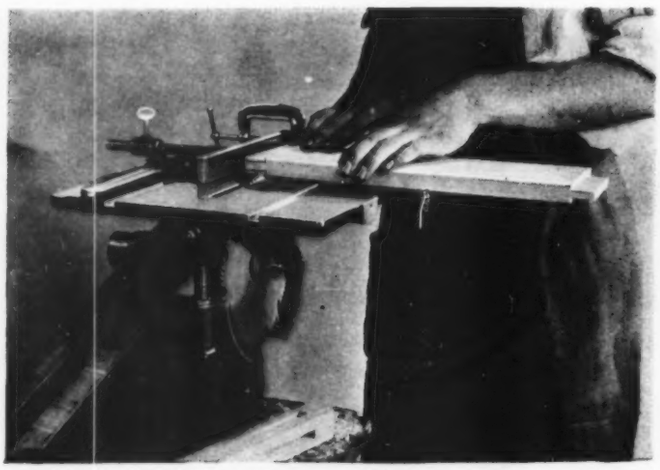


Fig. 4. When sawing to length, clamp a suitable wooden block against the fence to prevent binding and thus eliminate the danger of an accident.

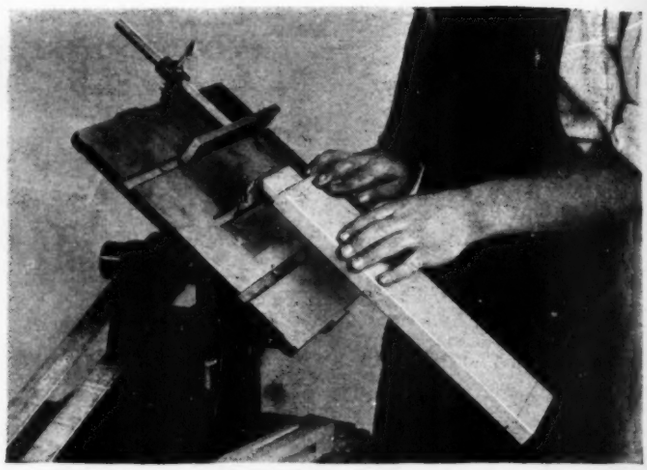


Fig. 5. Cutting a miter with the circular saw. Note how the hands are placed relative to the work and especially the operator's right hand.

order that it can be made to fit perfectly.

Fasten the upright trellis strips securely to these posts, being sure to get all members plumb, and then nail the ⅞ by 1½ in. trellis crosspieces in place. The crosspieces are cut just a little longer than the depth of the curved portion of the trellis.

THE GATE. This is an instructive machine project and furnishes a good opportunity for you to use your groover. Get out all the necessary stock to the correct sizes (see Fig. 6) and smooth the surfaces by ripping to thickness and width on the circular saw and then doing all of the jointing on a bench planer.

Joints. Lay out and cut the mortises and tenons to fit, allowing for the grooves. Make the circular top for the gate of three courses of segments, which are glued and screwed together. Next, groove the stiles and the bottom and top rails with a ¾-in. groover. Assemble the gate with waterproof casein glue and nails. Cut the splats to fit the grooves, nail and glue them in place, and carefully fill the voids between them with small wooden blocks. Nail two cross strips over the eleven splats to give the appearance of an intermediate rail and also to furnish additional strength and rigidity.

Hang the gate with hand-wrought iron strap hinges and fit a hand-wrought latch in place (see Fig. 6). This hardware can be purchased as stock material from any large hardware dealer.

Painting. Since the delicately curved outline of this type of trellis should stand out when it is covered with a rose vine, it is customary to paint it either a white or a light cream.

Apply a priming coat of zinc and white lead paint and oil mixed with a little turpentine and drier. Allow several days for this to dry and then putty all nail and screw holes with a putty made of white lead and whiting. Apply a second coat of paint mixed with a larger amount of raw linseed oil and less turpentine, not forgetting to add the drier. Allow a week for this coat to harden thoroughly and then apply the last coat of zinc and lead mixed with oil and drier only. If preferred, a high-grade ready-mixed commercial paint of the desired color can be used.

It will pay to do the painting in a first-class manner, for after the roses begin to climb over the trellis, it will be difficult to touch up any small spots that may show wear from the weather or that may result from the use of a poor quality of paint.

By varying the depth of the trellis (shown as 9 in. in the drawing), it is possible to adapt this design to any requirements which may exist.

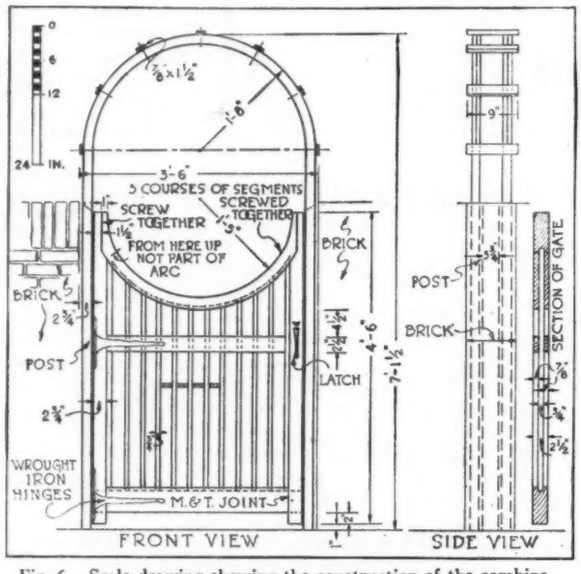
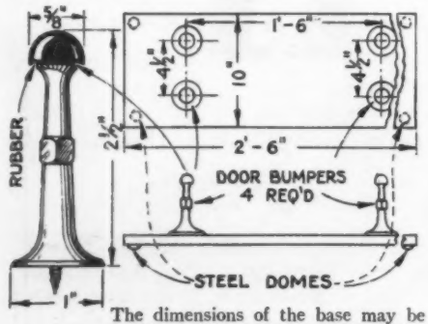


Fig. 6. Scale drawing showing the construction of the combination trellis and garden gate. The depth may be varied to suit.

Door Bumpers Used in Mounting a Ship Model

FEELING that the appearance of ship models is often spoiled by the use of an unattractive and bulky mounting, the writer designed and built the simple and yet attractive base illustrated.

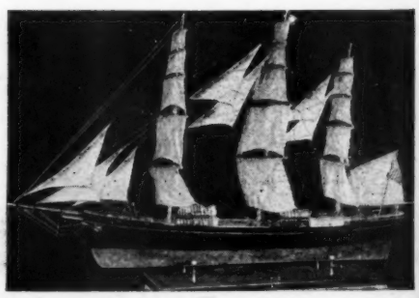


The dimensions of the base may be varied to fit any size ship model.

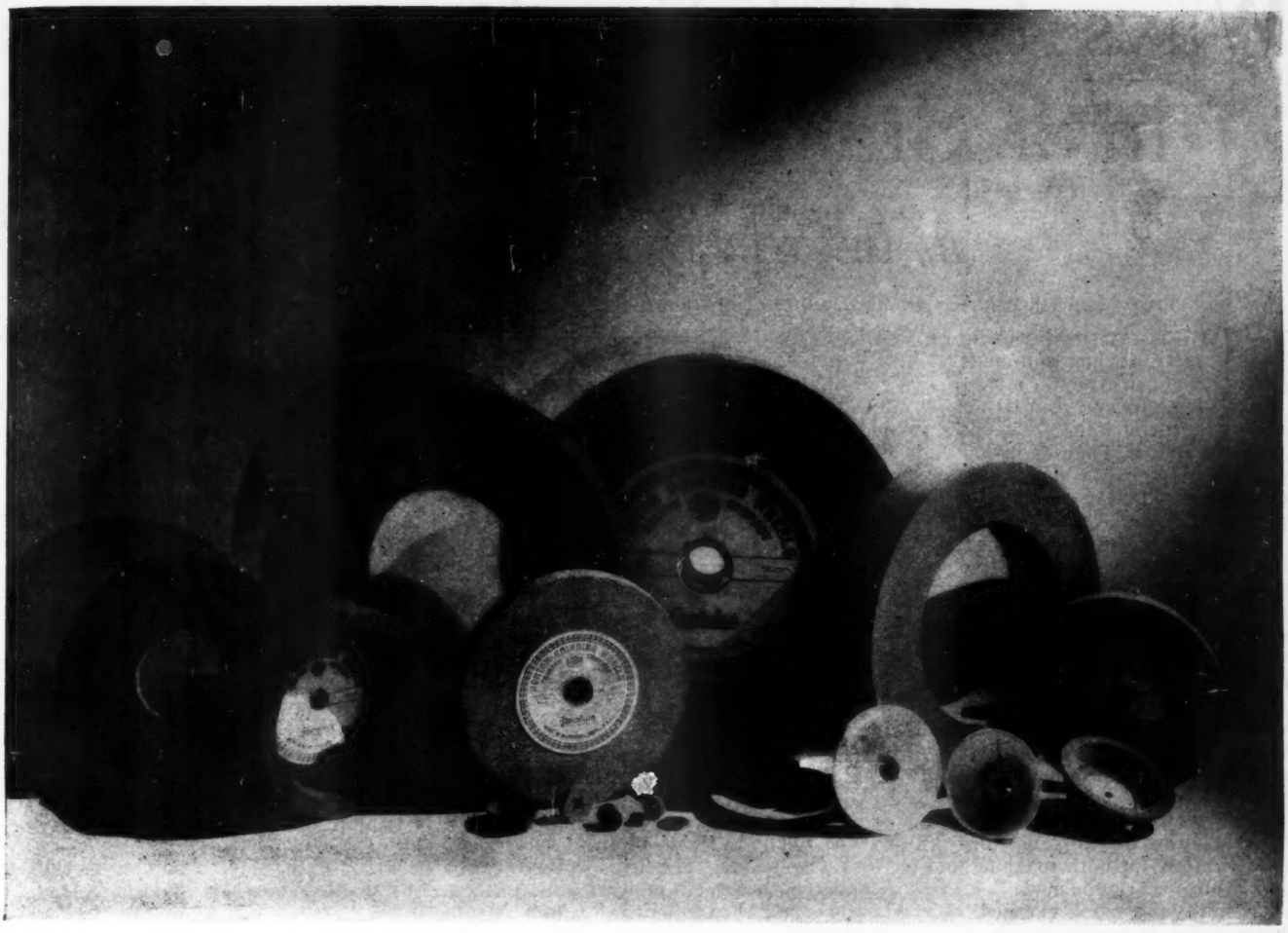
The mounting consists of four cast bronze door bumpers having rubber tips on their ends, four metal domes or slides, and a piece of stock of a size to accommodate the model. These bumpers can be obtained in a variety of sizes, the 2½-in. length, however, being the best suited for the average ship model.

In the case of the writer's model, the base was made 10 in. wide and 2 ft. 6 in. long, and the bumpers were placed 4½ in. apart along the width and 1 ft. 6 in. apart along the length. The steel domes were placed near the corners on the underside of the base and serve as feet.

By varying the dimensions of the bumpers and wooden base, this type of mounting can be made to fit a ship model of any size.—H. L. WHEELER.



The model is the *Sovereign of the Seas*, from Blueprints Nos. 51, 52, and 53 (page 110).



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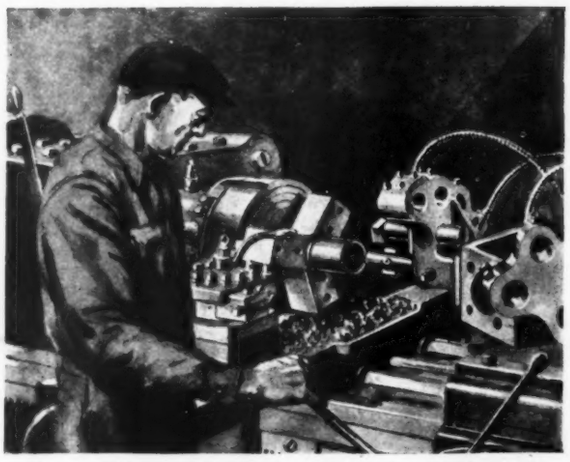
Ways to Cut the Boring Costs in a Small Jobbing Shop

By HECTOR J. CHAMBERLAND

HOW is the small jobbing machine shop to provide a sufficient supply of boring bars and reamers for use in the turret lathe? That is the next question in our discussion of boring problems which began last month (P.S.M., May '30, p.90).

If a shop had to be equipped with every size reamer needed, a small fortune would be invested in this item alone. To avoid such an expense, a serviceable equipment of boring bars and adjustable reamers is a necessity for use in both the ordinary turret lathe and the heavy-duty vertical turret lathe. Once an assortment of arbors is in stock, the cost of making blades is small.



If accurately ground for the material being machined, a boring bar will rival the excellent finish and precision of a reamer.

Some shops prefer to buy adjustable boring bars, because they can be set accurately for both roughing and finishing, but bars can be made that are just as accurate and much cheaper. A good design for a shopmade bar is shown in Fig. 1.

The slot is milled in the bar with a straight end mill, the radii being left as they are. This eliminates the filing of flat surfaces, which takes considerable time. Corresponding radii are milled on the long edges of the blades. The right-hand cutting side is relieved with a 3° straight clearance angle, which penetrates the slot 1/16 in. on each side. Unless the tool is made to bore to a shoulder, a radius of from 1/16 to 1/8 in. should be filed on the corners with a 3° eccentric clearance, and 1/32 in. allowance on the length for grinding. After being hardened, the blade is surface ground for a snug fit on the thickness and the width. A wheel is shaped to grind the necessary amount off the full radius side of the cutter blade.

The blade is then fitted to the arbor so that both corners indicate alike on centers, and then cylindrically ground to size. Both sides can then be relieved as needed by using a cup wheel. A 3° clearance angle is advisable with a 1/16-in. land for brass and bronze, 1/32 in. for steel, and 1/64 in. for cast iron.

If the turret lathe is not in very good shape, boring bars should be ground to a taper. They should be from .005 to .010 in. smaller at their back end so as to compensate for misalignment.

If the bore is of a size for which no reamer is available, a roughing bar 1/32 in. undersize is used first in work such as bushings and sleeves. If cylinders are being bored, the finishing bar is made .005 in. undersize, and the bore is machine-honed to the right size.

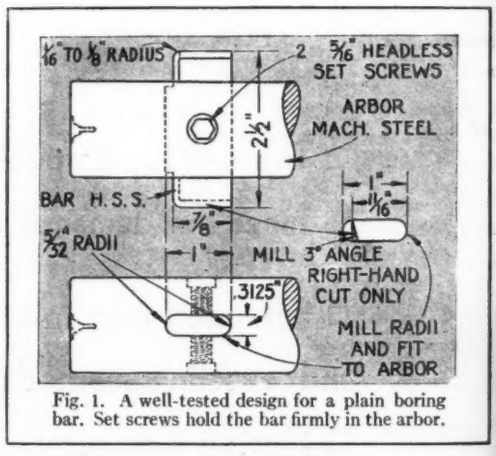


Fig. 1. A well-tested design for a plain boring bar. Set screws hold the bar firmly in the arbor.

Boring bars are used successfully up to 12 in. in diameter. For larger bores, the lathe style boring tool is used, and the work is also machine-honed and lapped, if necessary.

Whether the boring bar or the adjustable reamer finishes a bore, the tool should be guided by a substantial chamfer.

Unlike boring bars, reamers of the adjustable type are never shopmade. They are generally on hand in sizes up to 2 by 1/16 in. and from 2 to 4 by 1/8 in. Their convenience and economy lie in the fact that they can be set to dimensions plus or minus to accommodate special bores, which are often encountered in a jobbing shop. Furthermore, they can be kept always in perfect condition and to exact sizes by grinding them all over.

Any adjustable reamer that has been reset should be checked for size by a toolmaker or inspector before being used. The original size should remain stamped on it if only temporarily set plus or minus, but it should be returned to standard and reset before being turned into the tool crib. If such a reamer has to be reground for a different material, the tool should be set .010 in. oversize and then ground cylindrically.

Although most reamers are floated, it is well to taper them from .003 to .005 in. to take care of any misalignment. A clearance angle of 5° is recommended for these reamers, but a land should be machined as follows: 1/32 in. for brass, bronze, or aluminum; .020 in. for tool steel; .010 in. for machinery steel; and for cast iron, a .005-in. land honed to a sharp edge. For brass, bronze, and aluminum the chamfered corners should be honed to a 1/64-in. radius and larger, according to size.

In concluding these hints, two other suggestions are given; a special double boring and turning tool used on cast-iron union bushings and many other turret lathe operations, illustrated in Fig. 2, and a facing tool used on radial drill operations, in Fig. 3.

Boring boils down largely to this—if a twist drill, boring tool, or adjustable reamer is 100 percent efficient in itself, the machinist has his job half done before he starts.

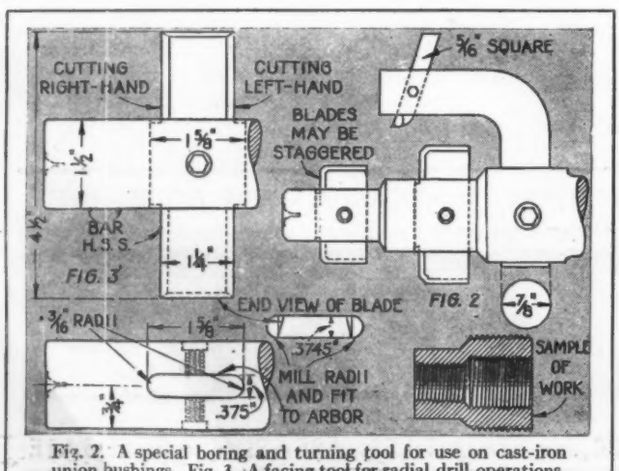
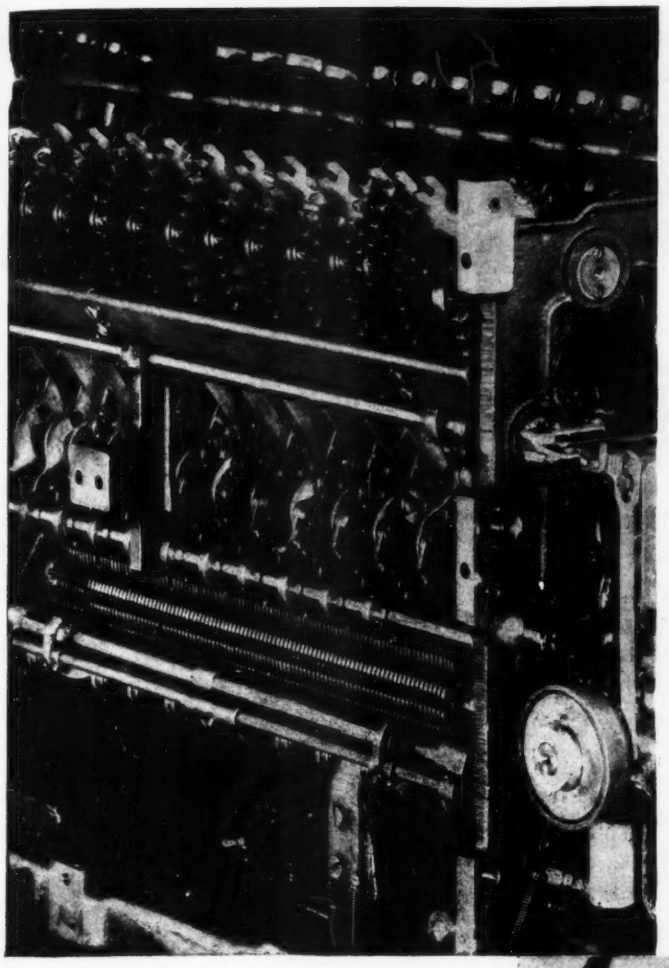


Fig. 2. A special boring and turning tool for use on cast-iron union bushings. Fig. 3. A facing tool for radial drill operations.



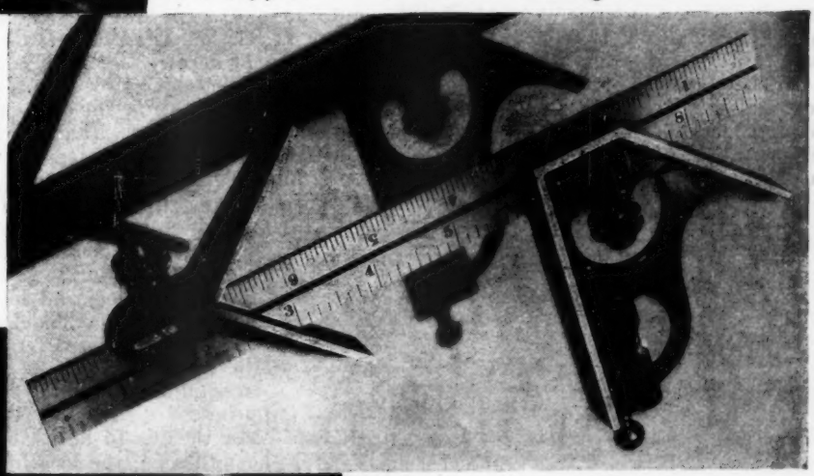
This Metal Brain Never Slips

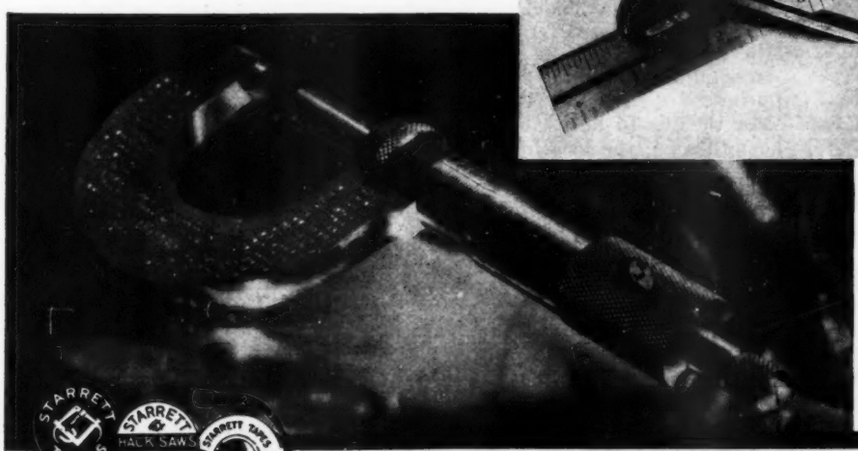
In hotels and banks and offices — wherever figuring progresses beyond the pad-and-pencil stage — a new bookkeeper is at work. A steel-memorized bookkeeper that carries as high as thirty totals in its head, adding or subtracting as entries are made, printing items and totals, descriptions and dates, in one operation, on bills and vouchers and record forms.

Tireless, performing its unbelievably complex jobs at a lightning clip, the accounting machine is a creature of accuracy. Most of its thousands of parts are made to accuracies of 0.001" and less — accuracies attainable only with the finest precision tools—tools like Starretts.

In serious work, or in your home work-shop, your hands will borrow added skill from Starrett Tools—the tools that master machinists prefer. Send the coupon for your free copy of the new Starrett Catalog No. 25 "W".

Mechanism of the National Cash Register Co. Accounting Machine. Below: Starrett Micrometer No. 230, typical of the precision tools used by master machinists. Right: a tool that belongs in every kit, Starrett Combination Square No. 33 with Center Head—8 handy accurate tools in one—another of the more than 2500 Starrett Tools described and illustrated in the new Starrett Catalog No. 25 "W". Send the coupon today. Ⓘ





THE L. S. STARRETT CO., ATHOL, MASS.
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How Long Should a Thread Be?

HENRY SIMON, Distinguished Authority on Machine Shop Practice, Answers This and Other Questions on Nuts and Screws

Cleaning threads with one of the simplest types of cleaners. Others are shown in Fig. 8.

JUST as a trifling clue often holds the solution of a mystery, so in many types of machine shop problems there is some minor and generally overlooked factor that is responsible for success or failure. This article and one to follow will call attention to a number of the less familiar facts regarding the use of threads and threaded parts and will suggest practical solutions for many of the threading problems encountered by machinists.

To begin with the common jam nut, there is nothing wrong in Fig. 1 at *A*, where the jam nut *a* locks a nut that is set up hard on a machine. But the same jam nut is a constant source of trouble when the first nut is used in a place where it must be nicely adjusted, as shown at *B*, because of its tendency to "grab" and pull the nut to be locked beyond its adjustment. In many cases a twentieth of a turn makes all the difference between right or wrong even with a slow lead, as may be seen from *C*. By simply facing the jam nut as at *D*, the grabbing tendency is reduced to about one third.

A bad condition in any nut, and especially in two nuts working against each other, is the not infrequent one shown at *E*, where bulging thread ends crush each other at *a* and prevent the necessary friction between the faces of the nuts at *b*. The nuts should be properly chamfered as at *F*. Furthermore, when maximum holding friction is desired, it pays to "dish" the contact face of the nut as shown exaggerated at *G*.

A common and sometimes serious defect in ordinary nuts—and one which aggravates the grabbing tendency of lock nuts—is the "unsquareness" of a nut as shown in Fig. 2 at *A*. This trouble, too, is minimized by shouldering the nut face as at *B*. For particular work, especially where the nut runs on a hardened male part under heavy pressure, a lopsided pull should be avoided, because the threaded stem may be sprung and ultimately broken, as illustrated at *C*.

SIMPLE and effective devices to square the faces of a nut with the thread are given at *D* and *E*. The former, however, should be used only in cases where the hole is very nearly central in the nut. With the special arbor shown at *E*, any nut, no matter how eccentric, can be squared. The only condition is that the arbor should be carefully made and the chuck jaws "square" as indicated at *F*, although they may run out of the center by almost any amount within reason.

How long should the thread in a nut be? Many mistakes are made in respect to this question. Fig. 3 at *A* gives the answer insofar as the jam nut is concerned. The reduced length of the nut requires less space, and helps to neutralize any small defects in squareness. It is, nevertheless, still sufficient to give all the strength necessary for locking purposes.

In threads to be used under heavy strain, the length of the nut sometimes depends upon whether in case of failure the lesser evil would be to allow the thread to strip or the stem to break. Fig. 3 at *B* and *C* shows the relation between the thread diameter and the length of the nut to insure either one or the other. This only holds true, however, in ordinary cases, and where both parts are made from the same metal.

Because of the heavy service and wear on set screws and lock screws, it is best to have them engage by from 1½ to 2 times the diameter in the female thread, as at *A*, Fig. 4. It is useless to go beyond that.

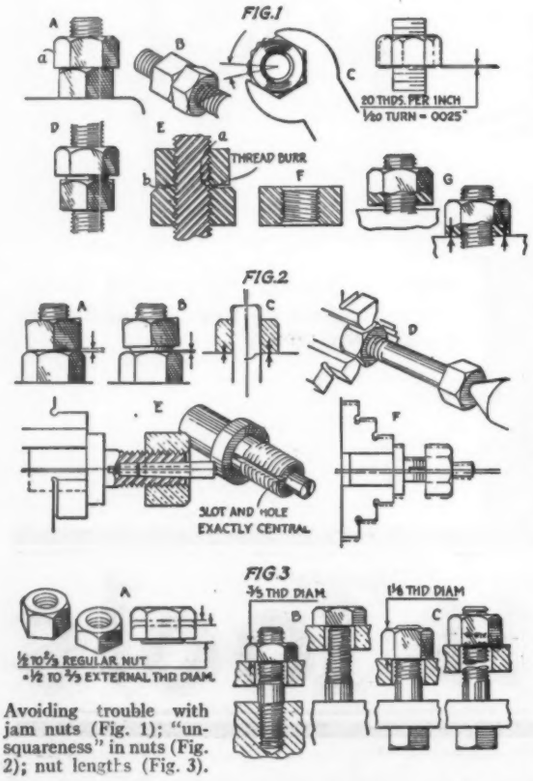
Although set screws are sold with threaded portions many times as large as their diameter and similar to the one shown at *B*, it is bad practice to use such screws in a long threaded hole, as at *C*, unless there is absolutely no help for it.

The aim in making the threaded stem long is to give the screw a wide range of adjustment for cases similar to *D*. As such screws are hardened and as shrinkage usually aggravates the natural lead error, excessive friction and jamming readily occur when such screws are used as shown at *C*, while no better hold is obtained than if the thread were 2 diameters long. Under such conditions, breakage at some point low down, as at *E*, may present a difficult problem and may make the screw cost literally its weight in gold. If a screw is to be used in a long hole, it is far better to take a short screw and use a pressure pin, as at *F*.

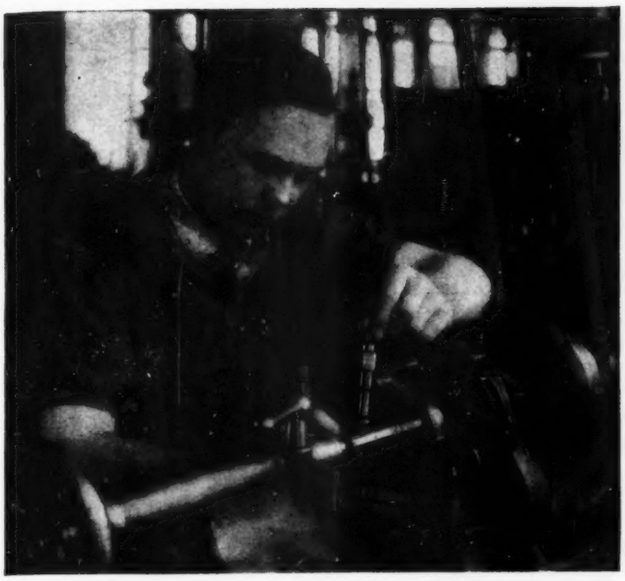
Where a thread is exposed to continuous wear, the male and female parts in engagement should not be less than 2 diameters long; and 3 and 4 times the thread diameter may be advisable, as is indicated at *A* in Fig. 5. Threads that are engaged over such a length, however, must be very accurate as to lead, or the only result will be excess friction. How easily an ordinary lead error may bring this about is portrayed in the diagram at *B*. As lead errors will occur, the best rule is to use only a moderate length of female thread, wherever possible—say about 2½ times the thread diameter.

IN CONTRAST with the question of how long a nut may be, it may be interesting to mention that the shortest full V-form nut that allows for anything like adequate chamfer is 1½ threads long, as shown at *C*. Partial threads of square form, such as at *D*, are occasionally useful where wear is light. If below one third the mean thread diameter in length, they may be made in the form of a plug insert as illustrated at *E*. This may take the shape of a slab-ended pin, as at *F*. Extremely simple, but inferior for wear, is the plain round pin at *G*.

Where the engagement between threads



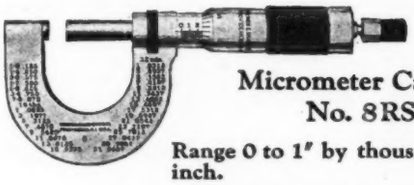
Avoiding trouble with jam nuts (Fig. 1); "unsquareness" in nuts (Fig. 2); nut lengths (Fig. 3).



The "first" tool in a mechanic's kit

What skilled mechanic would think of having a kit without a Micrometer Caliper? The variety of jobs where it is needed and its importance for fine work make the micrometer the "first" tool in a mechanic's kit.

Over sixty years ago Brown & Sharpe supplied skilled mechanics with their first micrometer. Improvements and additions have been constantly made until today there are over 400 different Brown & Sharpe Micrometers. Each maintains the high standards of quality and accuracy which have made Brown & Sharpe Tools famous the world over. A few representative types are shown here.



Micrometer Caliper No. 8RS

Range 0 to 1″ by thousandths of an inch.

Long a favorite with mechanics.

Micrometer Caliper No. 47RS

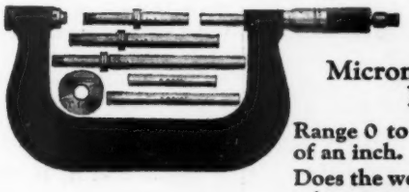
Range 1″ to 2″ by thousandths of an inch.

An excellent tool for making accurate measurements between 1″ and 2″.

Micrometer Caliper No. 11RS

Range 0 to 1″ by thousandths of an inch.

Special design of frame enables the user to take measurements over a flange or shoulder.



Micrometer Caliper No. 54

Range 0 to 4″ by thousandths of an inch.

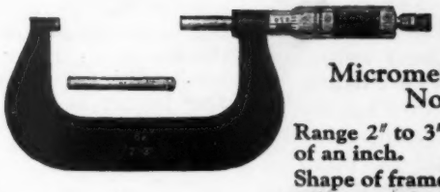
Does the work of four ordinary micrometers. Especially suited for automotive service work.

Other micrometers of this style can be furnished having a combined range of 0 to 24″.

Micrometer Caliper No. 24RS

Range 0 to 1″ by ten-thousandths of an inch.

Ten-thousandths can be read as easily as thousandths on an ordinary micrometer.



Micrometer Caliper No. 62

Range 2″ to 3″ by thousandths of an inch.

Shape of frame gives full measuring capacity.

Other micrometers of this style can be furnished having a combined range of 0 to 12″.

Your dealer will be glad to supply you with any Brown & Sharpe Micrometer Caliper. Our Small Tool Catalog No. 31 describes the full line. Ask your dealer for a copy, or send to us for one. Dept. P. S., Brown & Sharpe Mfg. Co., Providence, R. I., U. S. A.

B·S

Brown & Sharpe Tools

"World's Standard of Accuracy"

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VLCHEK

ALL-PURPOSE PUNCH AND CHISEL SET

The largest selling punch and chisel set in the world

Like other Vlchek tools, the All-Purpose Set is the world's best seller because it's the world's best value. Two punches, three chisels, of popular sizes, in a handy metal container. Superior in toughness for all-purpose use because forged and tempered under Vlchek's advanced laboratory control. Produced in great volume, and sold at a sensational, low price by hardware and automotive dealers.

THE VLCHEK TOOL CO.
CLEVELAND, OHIO

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"THE WORLD'S LARGEST MAKERS OF SMALL TOOLS"

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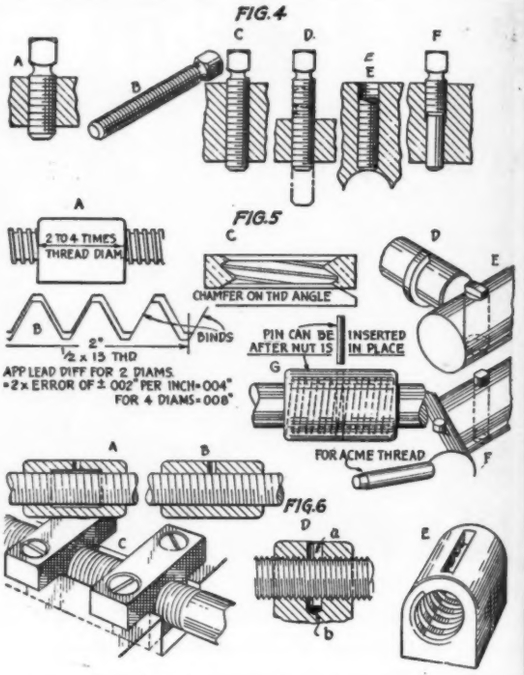
is long and the wear is constant, it is best to provide some interruption in the nut to allow the threads to clean themselves and to relieve friction. Though the advantages of this plan are great, it is used comparatively seldom. Such "breaks" may be of a variety of kinds. The interrupted long nut of *A*, Fig. 6, gives less friction, longer wear, and at least the same effective accuracy as the solid nut at *B*. An elaboration of the same plan is that at *C*, where two separate nuts, with space between them, practically overcome one half the lead error, be ides distributing wear evenly over the screw.

AN IMPROVEMENT over an ordinary oil hole is illustrated at *D*, where the continuation of the hole *a* forms a pocket *b*, in which dirt and foreign matter have a chance to settle, without allowing oil to escape. A more intensive cleaning and oiling action may be obtained by slotting the nut lengthwise, as shown at *E* in Fig 6.

What has just been said refers to female threads that are working parts of machines or fixtures. Plain bolt nuts that are frequently moved may be made self-cleaning and easier running without materially weakening their strength by filing a notch opposite a corner as at *A*, Fig. 7. This is generally preferable to making provision for the cleaning on the male thread; although that, too, may be done with a file as at *C*, or by milling as at *D*. The latter is preferable because it strips the dirt off more effectively. Even a plain hole crosswise through a nut, like in that shown at *E*, will prove to be a decided help.

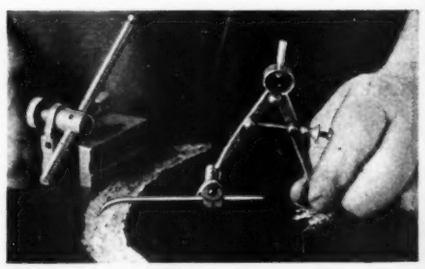
Figure 8 at *A*, *B*, and *C* illustrates nut cleaners which do their work without cutting. Unlike taps, they adapt themselves to variations in thread diameter. The spring wire device at *B* is especially suitable for cleaning the threads in chucks and faceplates. In common with the one at *C*, it cleans either right- or left-hand threads. The cleaner of *C* may also be set to give a slight shaving action for smoothing any rough spots that exist in a nut.



Pointers on using set screws (Fig. 4); short and long nuts, and pin fastenings (Fig. 5); interrupted threads (Fig. 6).

Mr. Simon will conclude his discussion of threading in the June issue.

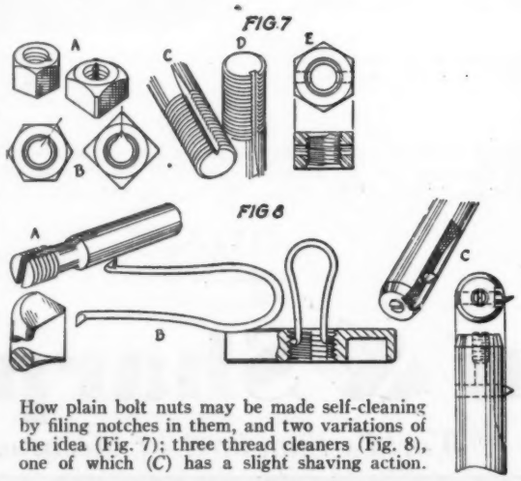
Scriber Increases Range of Machinist's Dividers



A surface-gage scriber clamped to small dividers makes it easy to lay out large circles.

A MECHANIC usually engaged on small work may not care to carry large dividers for the rare occasions upon which he needs them. In this event, he can make a small pair of dividers serve for laying off work otherwise beyond their capacity by utilizing the scriber of a surface gage as illustrated above. The scriber is fastened to one leg of the dividers by means of the regular clamp of the surface gage. The only work required is to make a small split bushing to fit the surface-gage clamp and drill it to receive the leg of the dividers.—H. MOORE.

IN AN emergency a leather or rubber power belt can be laced with a piece of electrician's tape, twisted lengthwise to form a cord a trifle thicker than a match.—H. W. SWOPE.



How plain bolt nuts may be made self-cleaning by filing notches in them, and two variations of the idea (Fig. 7); three thread cleaners (Fig. 8), one of which (*C*) has a slight shaving action.

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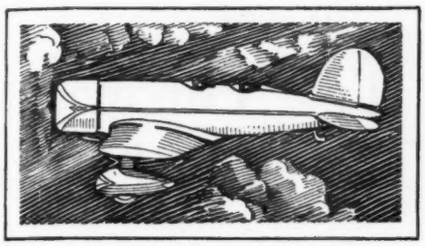
Whittled Model of Lindbergh's Plane

WHAT could be a more interesting toy model to whittle from wood than Colonel Lindbergh's new low-winged sport plane? Every line in its fuselage is symbolic of streamlined speed and grace.

The fuselage can be cut from a 1½ in. diameter curtain pole. Notch the under-



The toy is a copy of Colonel Lindbergh's new, speedy, two-place, low-winged sport plane.

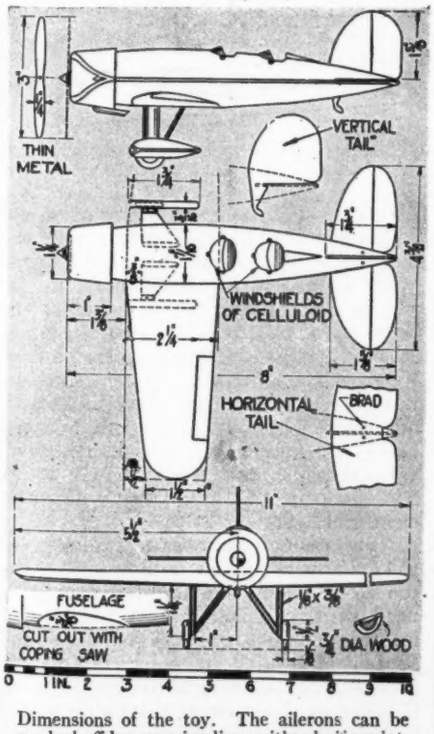
portion of the fuselage as indicated to take the wing and cut in the cockpits with a half-round file. Thin metal is used for the horizontal and vertical tail units.

A plane and a penknife are the only tools needed in shaping the wing from a ⅜ by 2¼ by 11 in. blank of softwood, such as white pine.

The propeller can be cut to shape from a piece of thin metal, and a thin nail or brad will serve for the shaft.

Cigar box wood ⅛ in. thick will be satisfactory for the landing gear struts. Make one complete wheel, cut it in two, and glue one of the semicircles to each of the streamlined housings. The landing gear is held in place with brads and glue.

Paint the landing gear and fuselage black, the wing and tail red, the propeller silver, and make all the striping gold or yellow.—DONALD W. CLARK.



Dimensions of the toy. The ailerons can be marked off by grooving lines with a knife point.

Handymen who want a boring & screw-driving tool that will work any place, will buy the

"YANKEE" SPIRAL RATCHET SCREW-DRIVER

With These Attachments:

3 Screw-driver Bits, 1 Bit with Screw-holder, 1 Bit with Screw-eye Holder, 1 Chuck (for holding drills), 8 Drill-points, 1 Countersink. And (for jobs calling for small nuts), 1 Hexagon Socket.

Ⓢ

HERE is a screw-driver that drills holes, countersinks the holes for the screw-heads, and drives in the screws —all simply by pressing on the handle. In the same way, it runs up small nuts. And all at express speed! Or it does all these jobs by ratchet movement.

It is a Spiral Screw-driver or a Ratchet Screw-driver, either right or left hand, or a Rigid Screw-driver, at will.

Driving Screws at express speed

With the *spiral* movement, the drill or bit is revolved by a spiral in the tool, when handle is pressed down.

With *ratchet* movement, you turn drill or bit by moving the hand forward and back without releasing your grip on handle.

Fast drilling with the "Yankee" Spiral

Both *spiral* and *ratchet* movements are instantly available. They may be used successively: sending screw in by spiral and setting it up by ratchet.

A simple adjustment makes it a 13-inch screw-driver, or, for long overhead reaches, an 18¼-inch screw-driver.

With a bit for small screws, another for medium screws, and a third for large screws, it is *three different size* screw-drivers.

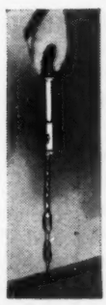
A *fourth* bit, with the "Yankee" Screw-holder Attachment, places and drives screws one-handed, in hard-to-get-at places.

Screw-holder

A *fifth* bit holds and drives screw-eyes.

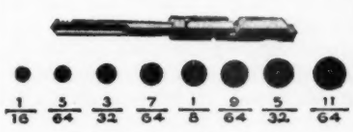
Countersink

Eight "Yankee" Drill-points for boring holes 1/16" to 11/64", with special chuck for holding the drills are supplied for this screw-driver.



Countersink is provided, fitting into the tool same as screw-bits.

Sockets for running up nuts are made to fit into this tool.

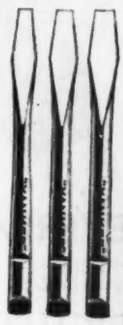


"Yankee" Chuck and Eight Drill-points

Simple adjustment makes it 18¼ in. driver for long overhead reaches.

Spring in handle makes it the "Quick-Return." Great for working one-handed.

Three different size screw drivers in one



No. 30-A.—Standard Spiral Ratchet Screw-driver used the world over by skilled mechanics. Price, for tool with three screw-driver bits, $3.00.

Also made Heavy and Light Patterns.

No. 130-A.—Spring in handle makes it the Quick-Return Spiral Ratchet Screw-driver. Price, with three bits, $3.45. Also Heavy and Light Patterns.

"Yankee" attachments sold separately. Your dealer can supply you.

FREE "YANKEE" TOOL BOOK

To Help You Make Things, we will send book with action pictures showing the ingenuity in use of many "Yankee" Tools. Mail coupon to NORTH BROS. MFG. CO., PHILADELPHIA, U. S. A.

Name.....*Address*..... (ps)

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PROVED PERFORMANCE

EVEREADY RAYTHEON TUBES FOR TALKING PICTURES, TELEVISION AND ALL INDUSTRIAL PURPOSES

These tubes have firmly established their position in the fields of talking pictures and television, and in the greatly broadening field of industrial usage.

The Eveready Raytheon Foto-Cell is a long-life tube for talking pictures, television and industrial purposes, such as control of illumination, automatic counting, paper-testing, color matching and others. It comes in several standard types, or can be made to specification.

The Eveready Raytheon Kino-Lamp is the first television receiving tube developed commercially that will work with all systems. Each tube is carefully tested.

We welcome inquiries from everyone interested in talking pictures, television and Foto-Cell applications of any nature.

* * * *

The Eveready Hour, radio's oldest commercial feature, is broadcast every Tuesday evening at nine (New York time) from WEAF over a nation-wide N. B. C. network of 30 stations.

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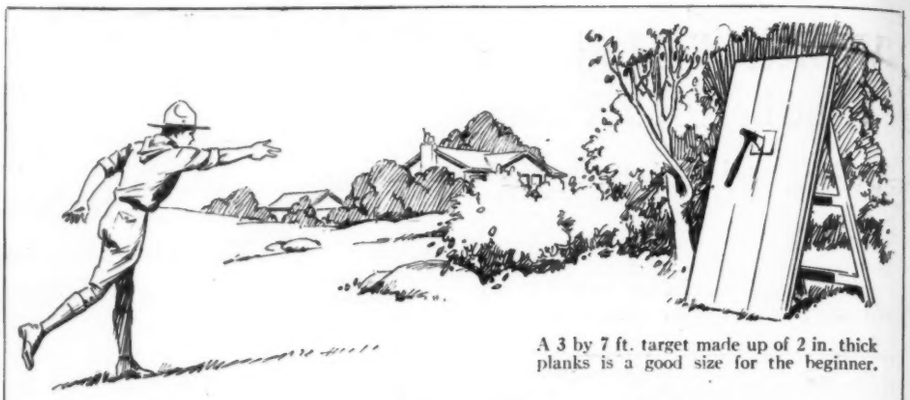


A 3 by 7 ft. target made up of 2 in. thick planks is a good size for the beginner.

For Real Sport Try Throwing the Target Tomahawk

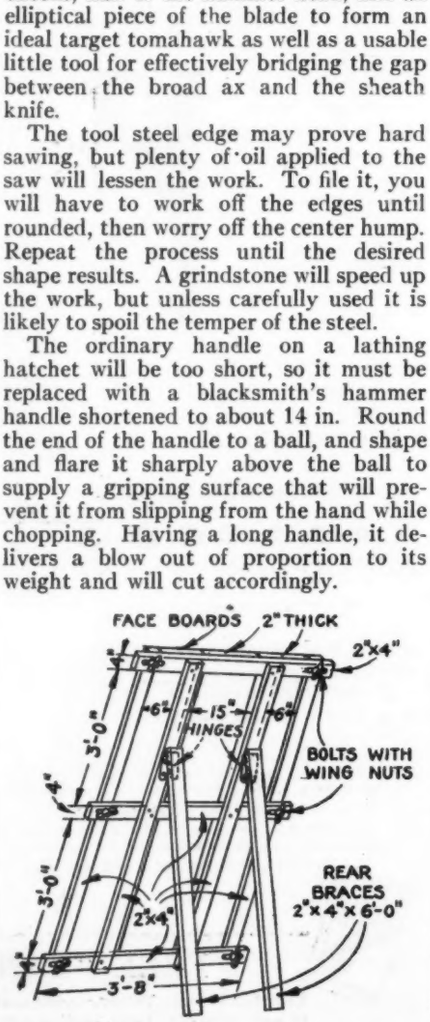
By JACK HAZZARD

TOMAHAWK throwing is all but a lost art, though none the less entertaining and safe, provided a suitable hatchet is used.

Good control demands a light missile, and it is possible to lighten the average lathing hatchet by hack-sawing away the cheeks, half of the hammer-head, and an elliptical piece of the blade to form an ideal target tomahawk as well as a usable little tool for effectively bridging the gap between the broad ax and the sheath knife.

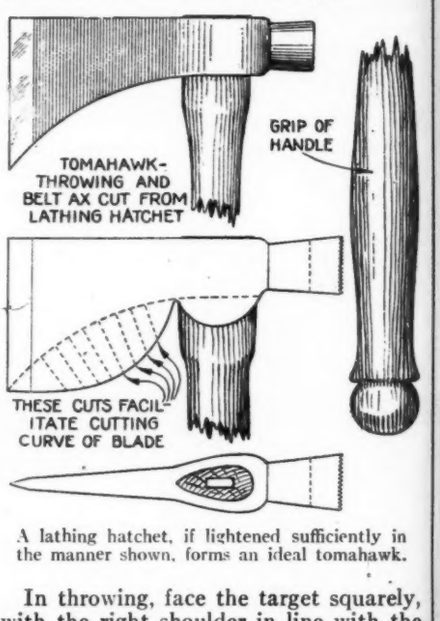
The tool steel edge may prove hard sawing, but plenty of oil applied to the saw will lessen the work. To file it, you will have to work off the edges until rounded, then worry off the center hump. Repeat the process until the desired shape results. A grindstone will speed up the work, but unless carefully used it is likely to spoil the temper of the steel.

The ordinary handle on a lathing hatchet will be too short, so it must be replaced with a blacksmith's hammer handle shortened to about 14 in. Round the end of the handle to a ball, and shape and flare it sharply above the ball to supply a gripping surface that will prevent it from slipping from the hand while chopping. Having a long handle, it delivers a blow out of proportion to its weight and will cut accordingly.



With this type of target, the face boards can be replaced when they become badly cut.

The secret of throwing a tomahawk lies in the fact that a properly balanced hatchet turns twice over in each ten or twelve feet when thrown overhand without snap, and once if tossed underhand. The distance can be increased by multiples of the base range until a strong arm will be needed to reach the target.



A lathing hatchet, if lightened sufficiently in the manner shown, forms an ideal tomahawk.

In throwing, face the target squarely, with the right shoulder in line with the center of the objective. Swing the tomahawk up and bring it down in an arc perpendicular to the target, and allow the body to swing forward when the ax is released with a smooth, snapless motion. Keep your eye fixed on the target and be wary of a rebound, should the tomahawk fail to strike fair. If properly thrown, the blade and handle will spin in the same vertical plane, and the edge will strike and stick in the target with a sharp, clear crack.

At a range of from ten to twelve paces a 12 in. wide plank is ample for the practiced hand, but the beginner may need three such planks. A target of 2 in. thick planks made 3 by 7 ft. and supported by a 2 by 4 in. frame is an excellent size on which to practice; and if made as shown in the drawing at the left, the face can be readily renewed.

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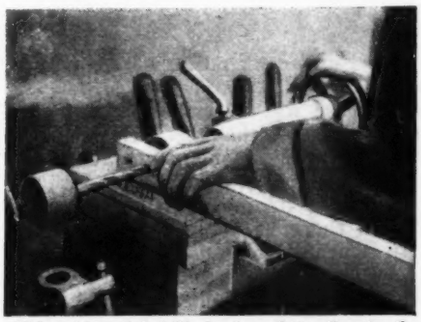
Easily Made Lathe Chuck for Bits and Drills

IN THE home workshop a wood turning lathe can be used for many purposes besides turning wood. For example, the drilling attachment illustrated sees constant use in one small shop. It is a simple matter to make such an attachment to fit any lathe.

Cut a piece of maple or hickory 2½ by 2½ by 6 in. for the drill chuck. Set it up in the lathe and turn it to a cylinder. Then turn a shank on the tail end to correspond to the dimensions of a center from the lathe. Remove the tail center and insert this shank loosely in the tailstock. With the spur center engaging the wood, turn the stock slowly and at the same time gradually increase the pressure with the handwheel until the motor begins to stall. This will burn all the high spots on the shank. Set it between centers again and turn to an exact fit.



This substantial drill chuck and the "pusher" in the tailstock are turned from hard maple.

When the fit is perfect, remove the spur center and insert the wooden shank into the headstock. Bore a tapering hole in the face of the chuck to the dimensions of the square, tapered shank of a regular wood bit. If you have no tool small enough, you can make one from an old saw file.

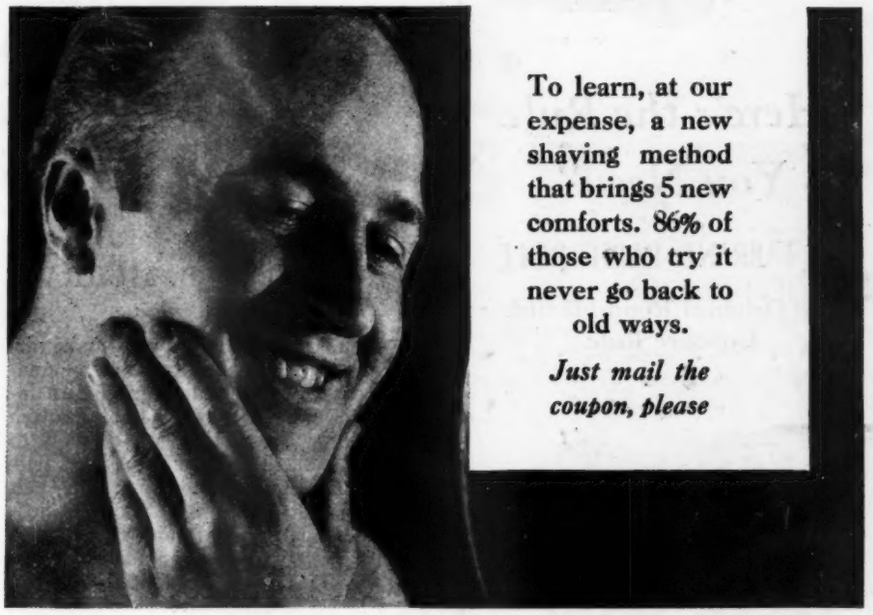
Grind the shank of the wood bit a little on each side to make the corners sharp. Hold the bit with a pair of pliers and use the shank as a turning tool to true up the hole. Be sure the hole tapers clear back to a point, and leave it round. Force the bit into the chuck as far as it will go, and it will be held almost as solidly as if in a heavy metal chuck.

This chuck works in either end of the lathe, takes a square shank twist drill up to ⅜ in. in diameter, and serves for wood bits up to 1 in. By using it first in the tailstock and then in the headstock, spindles up to twice the length of a wood bit may be bored through.

A preliminary step is needed when boring across grain in hardwood with a wood bit: a pilot hole as large as the lead screw of the wood bit must first be made with a twist drill, or the bit will lead into the wood too fast.

A "pusher" for use in the tailstock, as illustrated, may be made in the same way as the chuck except that it requires no boring.—GEORGE H. WHITEAKER.

WANTED Men with tough beards

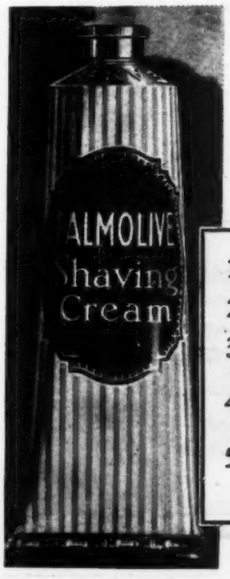


To learn, at our expense, a new shaving method that brings 5 new comforts. 86% of those who try it never go back to old ways.

Just mail the coupon, please

GENTLEMEN: This is a direct challenge to men who are hard to shave. Men whose stiff, stubbly beards make shaving a hardship. Who, in getting a close shave, leave the skin irritated and burning. For these men we have a message . . . and a challenge.

A 7-day test will convince you better than any words of ours. And the trial tube is offered at our own risk, because we know we'll make boosters of 86 men out of every 100 who make it. The coupon brings a free 7-day supply.



1 Multiplies itself in lather 250 times.
2 Softens the beard in one minute.
3 Maintains its creamy fullness for ten minutes on the face.
4 Strong bubbles hold the hairs erect for shaving.
5 Fine after-effects due to palm and olive oil content.

What our laboratories proved

Olive oil has long been the world's greatest cosmetic lotion. In soap it has been preferred by millions. Palmolive Soap, which we make, is the world's largest selling soap. Our problem was to apply the olive oil principle to a shaving cream.

An offer to open-minded men

If you are willing to be shown, give us a chance, please. We take the risk, not you. Simply mail the coupon and proof will come in a 7-day tube of shaving cream that we are confident will win you.

PALMOLIVE RADIO HOUR — Broadcast every Wednesday night—from 9:30 to 10:30 p. m., Eastern time; 8:30 to 9:30 p. m., Central time; 7:30 to 8:30 p. m., Mountain time; 6:30 to 7:30 p. m., Pacific Coast time—over WEAF and 39 stations associated with The National Broadcasting Company. 5889

7 SHAVES FREE
and a can of Palmolive After Shaving Talc

Simply insert your name and address and mail to Palmolive, Dept. M-828, P. O. Box 375, Grand Central Post Office, New York City.

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(Please print your name and address)

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"Here's the Rule You Need"

The FARRAND RAPID RULE

The Original Rigid-Flexible Concave Rule

On the job, in the office, or in the home workshop, you will find the Farrand rule one of the most practical inventions in years. It modernizes old methods of measuring, since it combines the better features of the wooden rule and steel tape without their many limitations.

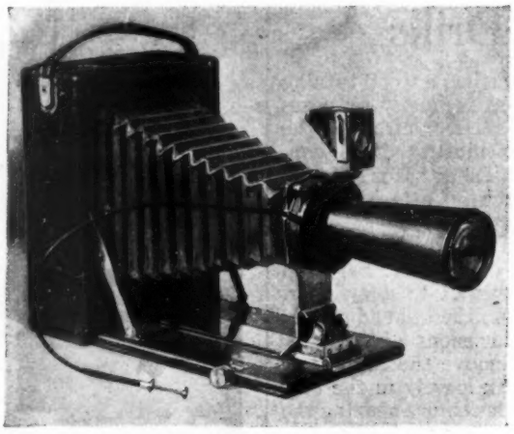
Will measure with equal ease straight or curved surfaces, and around bends. Six and eight foot steel rules coiled in a vest pocket sized holder. Instantly available for service by slight pressure on brakes.

Ask your dealer to demonstrate, or write to factory for six-inch sample of rule strip.

Manufactured by

HIRAM A. FARRAND, Inc.
Berlin, N. H.

Simply Made Telephoto Lens



The telephoto lens attached to a camera makes possible the photographing of objects at a distance.

By KENNETH B. MURRAY

PHOTOGRAPHERS who make pictures professionally, as well as amateurs who find photography an instructive and interesting hobby, often encounter subjects that are difficult to take without the aid of a modern telephoto lens. As the name indicates, this is a special lens used with the camera just as a telescope is used to aid the eye.

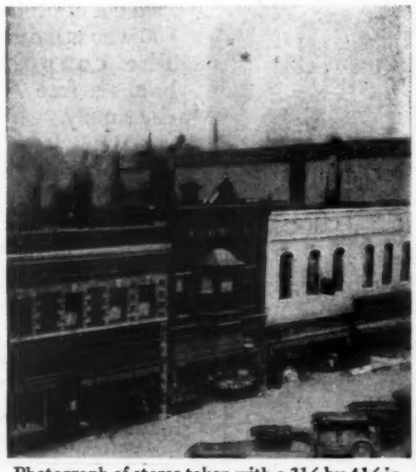
With the telephoto lens, distant scenes that are so far away it is difficult to locate them in an ordinary picture are brought apparently to within a few rods of the camera. The cost of such a lens is usually prohibitive for the amateur, but with almost no expense at all one can be made from an old opera glass, field glass, or telescope, provided it has lenses free from scratches. A glass with as large a lens as possible should be selected, for sometimes you may wish to make negatives with short exposures.

If an opera glass is used, only one of the two barrels will be required, therefore one glass will make two telephoto lenses. Remove the lenses and their metal cell mounts from each end of the barrel.

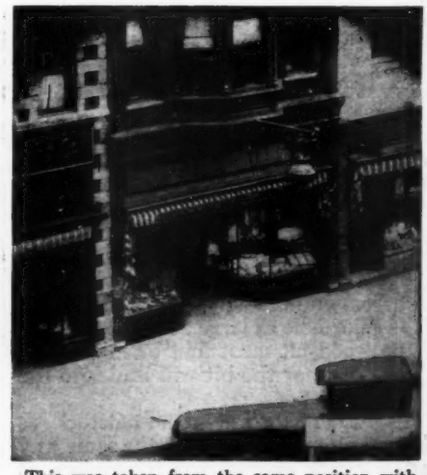
Select a piece of medium weight cardboard and roll it into a cone so that the smaller lens will fit securely in one end, and the larger in the other. The length of the cone should be about equal to the distance between lenses when the glass is fully extended in its mount. They may be held in the cone by friction or, better, with cement. This cone, naturally, must be so designed that the smaller end can be fitted to the camera by friction; and the fitting must be light-tight. The camera can be used at any time for ordinary pictures merely by replacing the regular lens.

In utilizing an old telescope, the large lens is removed and cemented into a cardboard tube. It is advisable to make the tube larger around than the lens so none of the corners of the prospective pictures will be cut off.

The inside of the cone or tube in either case should be painted a dull, nonreflecting black. India ink or black slate paint is suitable. When the lens is installed, see that there are no cracks around the ends where light can enter and fog a picture. It is a good plan to go over the outside of the cone with paint to match the camera. Several coats of shellac over



Photograph of stores taken with a 3¼ by 4½ in. Graflex camera on a hazy day last winter.



This was taken from the same position with the same camera fitted with a telephoto lens.

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this will toughen and strengthen the cardboard.

Upon the aperture diameter of the smaller lens depends the length of exposure that will be necessary. This may be readily governed by the iris diaphragm or "stop"; with some glasses it may be necessary to stop down the iris to get sharp definition over the entire film. With a telephoto lens it is necessary to give about twice the exposure customary for the size stop used. This is not a handicap on bright days; when the sun is shining brightly, the stop should be set at about f:11 with 1/25-second exposure.

It is advisable to use a support or tripod, as the slightest movement of the

Rolling the tube of a telephoto attachment to fit a lens removed from an old telescope.

camera is many times magnified on the film or plate. This also is true with manufactured telephoto lenses.

The inexpensive grades of opera and field glasses are not corrected for color, yet it will be found that pictures taken by this method in clear weather will be quite sharp and entirely suited for any but the finest technical work.

If your camera is of the plate or film pack variety with a focusing ground glass, it will be easy to focus for any distance. The same, of course, is true of the expensive cameras having reflecting mirrors. With the ordinary roll film camera some slight preparation is necessary. A new roll of film is used before making the telephoto picture. Remove the back, as if to insert the new roll, and hold a piece of ground glass, shiny side out, on the rollers over which the film passes. Focusing then becomes a simple matter.

Ground glass is usually easy to obtain, but if you lack a piece, some very thin white tissue paper can be used. The kind known as onion skin, or even tissue wrapping paper, will do. It should be stretched taut and glued to a frame cut from heavy cardboard. The tissue side is placed against the camera.

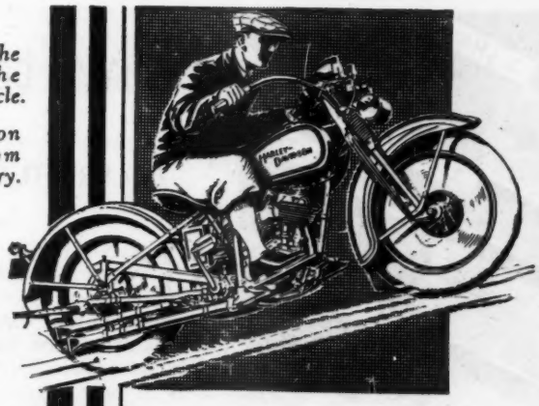
Padded Jaws for a Vise

WHEN a home mechanic has only a steel machinist's vise, it will pay him to make removable jaws that can be used for woodworking without leaving any scratches or dents. Take two pieces of copper or soft brass approximately 4 by 6 in., place them in the vise, tighten it, and with a hammer drive down the metal over each jaw until it is shaped to fit.

Remove the jaws and glue pads cut from felt such as is used on office chair seats to their faces. The finished jaws can be made at a cost of about twenty-five cents.—CHARLES R. WHITEHOUSE.

Shown here is the "45 Twin" — the ideal solo motorcycle.

Harley - Davidson prices range from $260 f. o. b. factory.



THE THRILL OF THRILLS

—any way you look at it!

MOTORCYCLING — the thrills of a dozen sports in one! A mount that responds instantly to every whim — now streaking down the highway — now zooming over a towering hill — now just purring along a winding by-road. A mount to be proud and fond of — not just transportation.

Answer the call of the Open Road with your own Harley-Davidson. What a glorious way to start the Summer! What a vacation you'll have *this* year! And the trips, the tours, and the week-end outings with the jolly Harley-Davidson bunch! Cost? So little you'll scarcely notice it — for a Harley-Davidson is easy to buy, and costs only a penny or two per mile.

Let your nearest Harley-Davidson Dealer demonstrate the wonderful "45 Twin" shown here, and the other 1930 models. Ask about his Pay-As-You-Ride Plan.

Ride a **HARLEY-DAVIDSON**

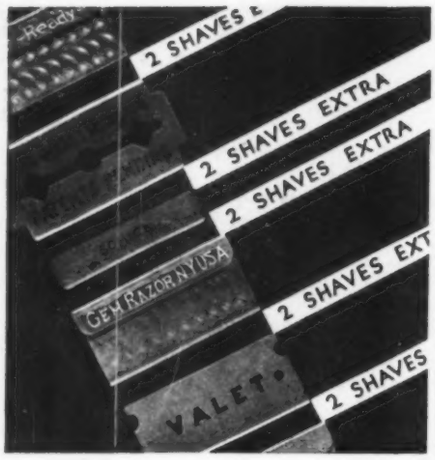
CLIP THE COUPON

HARLEY-DAVIDSON MOTOR COMPANY
Dept. P. S., Milwaukee, Wis.
Interested in your motorcycles. Send literature.

Name.....

Address.....

My age is ☐ 16-19 years, ☐ 20-30 years, ☐ 31 years and up, ☐ under 16 years. Check your age group.



ANY BLADE
will give you
2 More Shaves

...with Mennen Shaving Cream! (and I mean good ones). That's my money-back guarantee. Mennen shaves are better shaves, too. They *have* to be when Mennen lather makes any razor do its stuff well through 2 *more* shaves.

Mennen alone gives you two kinds of shaving cream...Menthol-iced and Without Menthol. Both give that clean, comfortable Mennen shave. Both build up a fine, quick lather in any water. Mennen Without Menthol is smooth and bland. Menthol-iced lather has a triple-cool tingle all its own. Both creams are typically Mennen...that's the main point...and my guarantee covers them both. Take your choice.

I hope you doubt my guarantee. I'd like to prove it. I'll even send you a trial tube to make the test if you use the coupon.

Have you tried the 6-second massage with Mennen Skin Balm? It prolongs the invigorating freshness of your Mennen Shave...cools and conditions your skin. It's non-greasy ...absorbs instantly.

Jim Henry
Mennen Salesman

MENNEN
SHAVING CREAMS

MENTHOL-ICED **WITHOUT MENTHOL**

THE MENNEN CO., Dept. P-3, NEWARK, N.J.
Jim Henry: Send me a free trial tube of Mennen, Jim. I'll try it with my razor.

Name.....

Address..... City.....

☐ *Send me Mennen without Menthol.*
☐ *Send me Mennen Menthol-Iced.*

How to Create Wire Puzzles

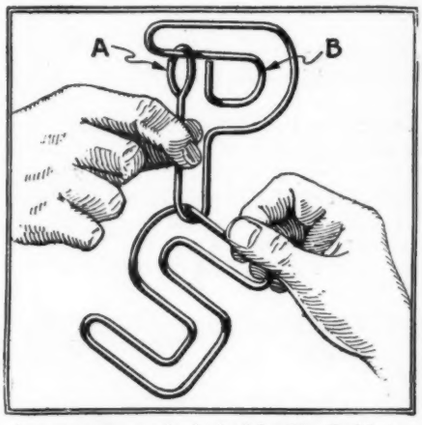
By ARTHUR L. SMITH

BY KNOWING the one simple wire puzzle principle illustrated in Figs. 1, 2, and 3, you will find it possible to arrange other wire puzzles of different shapes and forms, including monograms.

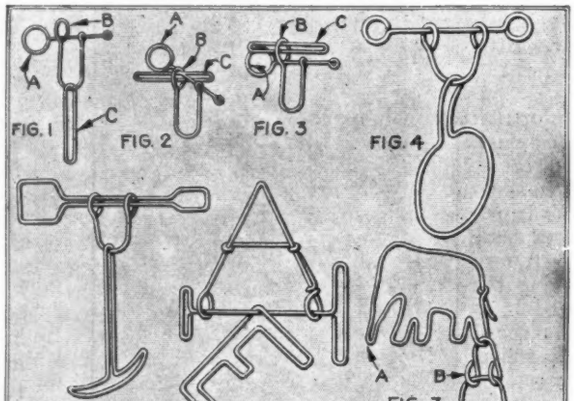
In the puzzle shown in Fig. 1, the loop *C* is to be removed. To do this bar *A* (Fig. 2) is lifted up and *C* is inserted through ring *B*. *A* is dropped down through *C*, which can then be withdrawn (Fig. 3). Other variations are shown in Figs. 4 and 5. In these two the wire is bent to the shape of familiar objects.

This same principle can be applied to the making of monogram puzzles. The distinguished initials T. A. E. may be arranged as in Fig. 6. If there are only two letters, as P. S., they can be put together as shown in the illustration at the top of the page. To solve this, the stem of the S is brought around to the top projection of the P. The wire is sprung downward and the stem of the S is inserted through the ring *A* and then over *B*, which frees it.

The puzzle may be made more complicated, as in the case of the chained elephant in Fig. 7. To release the elephant from his chain, his trunk *A* is first inserted through ring *B*. The rings *D* and *C* can then be worked through the loop of the trunk with a little manipulation. Ring *C* is slipped over the trunk, and *D* is brought through the loop again. *C* and *D* are now removed, and the elephant remains attached only to the lower combination *CD*, which is taken off by the same principle as used in the solution of the other puzzles.



A monogram puzzle devised by Mr. Smith to represent the letters PS—POPULAR SCIENCE.



The basic principle for making one popular type of puzzle is shown in Figs. 1-3, and several adaptations are given in Figs. 4-7.

While the reverse of this process will replace the elephant, it is rather confusing. The lower combination *CD* is put on first. Slip loop *B*, and then *C*, over the trunk, after which *D* is passed through the loop. *C* is slipped off, and *D* and *C* are worked through the loop. This allows *B* to be lifted off, and the elephant is again chained as it was at the start.

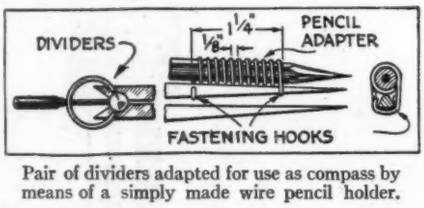
All the joints in these puzzles should be soldered in order to keep the various parts in shape.

Spring Pencil Attachment for Shop Dividers

A PAIR of dividers can be converted readily into a pencil compass by the application of the simple spring adapter illustrated.

A piece of .035-in. music wire is wrapped around a form until the spring reaches a length of 1¼ in. The ends are bent around so as to form two hooks.

This quickly made little device has been used by the writer for the past thirty years and he recommends it for use in toolmakers', sheet metal workers', and machinists' kits.—ROSCOE B. BOONE.



Pair of dividers adapted for use as compass by means of a simply made wire pencil holder.

GLUE and rags sometimes serve effectively for making small repairs to furniture. Suppose a caster in a chair or table leg has worked loose and the shank has chafed a large hole. Cut some narrow strips of rags, saturate them with glue, wrap them around the shank of the caster in sufficient quantity to fill the hole, and then force the caster in place. You may drive screws down through the flange of the caster into the glued rags, and when the glue hardens it will hold them firmly in place.—H. G.

Old Bill *Says*—

WHEN tapping holes with small and delicate taps, screw the tap wrench over the round part of body instead of on the square shank, because the wrench will slip before the tap will break. This will tend to eliminate a good deal of breakage.

Unless it can not be avoided, never use a lathe arbor for a grinding job. If you are compelled to, test it before you start.

For a lasting job on a bronze bushing, the bore should be smoothly ground to size.

Use plenty of oil when reaming cast iron. Then the reamer will not pick up a burr and cut oversize, and it will leave a smoother hole for dowel pins and bushings.

The cutting sections of drills, reamers, end mills, and other similar tools will do at least three times more work between grinds if they are chromium plated.

If it is possible to reach the adjusting screw of a reamer with a wrench, always do the adjusting without removing the reamer from the hole. This will help to avoid chatter and the formation of a bell-mouthed hole.

Pilots of counterbores always should be undercut next to the cutting edge for chip clearance.

Save the old reamers under ½ in.; these can be made into counterbores or end mills in case of emergency.

Red lead and oil is a useful and inexpensive substitute for the blue commonly used for spotting work that is being scraped.

When grinding a tool made of "stellite," use a wheel of a more open grain than for high-speed steel, and at least one grade softer.

Where to Look for Other Mechanical Articles

MANY short articles of interest to mechanically minded men are scattered through the magazine in the sections preceding the Home Workshop Department. If you happen to have missed any of the following, it will pay you to turn back to the pages noted and read them.

Pocket Gage Measures .001 Inch.....30
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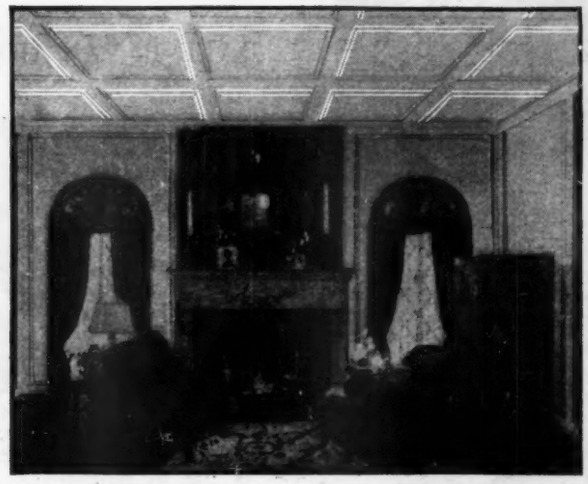

See how attractively an Upson Relief Ceiling has covered unsightly plaster cracks. This distinctive paneling . . . heretofore limited to expensive construction. . . can never crack or fall.

Re-cover cracked plaster with

Upson Relief Ceilings

Now you can get rid of ugly, sprawling plaster cracks *forever.*

Simply apply Upson Board right over the cracked plaster, that has been a source of embarrassment. There is little muss . . . no delay.

Any good carpenter can do the work in a few days. There is no fine, sifting dirt, that means general house cleaning.

You have an interesting variety of authentic designs from which to select your decorative scheme. The pebbled surface of Upson Board . . . shown in the border of this advertisement . . . can be finished in the popular colors of today.

Upsonized walls and ceilings give a house more than new beauty and comfort. They make it easier to sell or rent . . add more than their cost to its value.

The Upson Studios of Decoration and Color gladly furnish directions for application and suggestive color schemes. Write for booklets today.

Re-cover one cracked ceiling with Upson Board—then you will want to modernize your whole house with Upson Board.

UPSON PROCESSED BOARD

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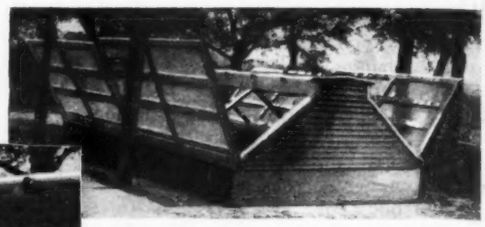
You can't keep music from your lips when the Ever-Ready coasts down your cheeks. The keen blade takes off the whiskers so quickly, so comfortably, so smoothly that you feel happy all day... Each blade gives many *more* shaves. Be a Singing Shaver—buy Ever-Ready Blades.

Product of American Safety Razor Corp.

Ever-Ready BLADES

Building a Sunken Greenhouse

By
DALE R. VAN HORN



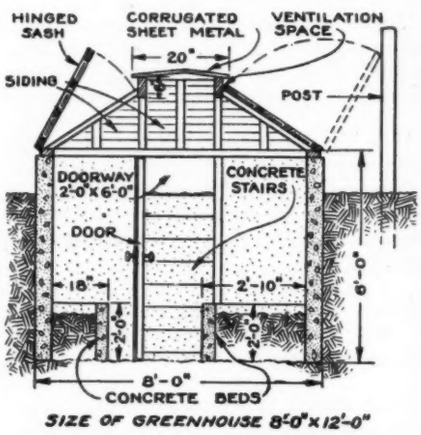
The small greenhouse with its sash raised, and a view showing construction at one end and framework for supporting the sash.

THIS well-designed although somewhat unusual sunken greenhouse is in use in northern Texas, but it should prove serviceable in colder climates provided the ventilators in the roof are covered during winter. Since the structure is almost entirely underground, the inside temperature is quite constant. Provision could be made for heating the greenhouse at relatively low cost.

The 5 in. thick walls are of concrete except the upper ends, which are of siding. Each side of the roof consists of two large sash hinged to the upper wall edge. Two 4-in. pieces, set to the roof pitch, support the sash. When open, the sash leans against posts, as shown in the drawing at the right. The center section of the roof is covered with a sheet iron strip 20 in. wide, the edges of which just clear the sash when they are closed down. This construction provides a ventilating space about 6 in. wide on each side, running from end to end.

Inside, the space is filled with concrete beds in which the plants are kept. The door is 2 ft. wide and runs to the top of the wall. Concrete steps lead down to it as shown below.

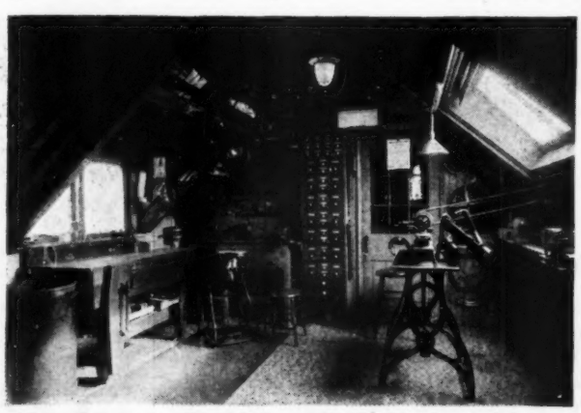
By providing doors to cover the ventilators during the cold weather, the greenhouse should maintain above-freezing temperatures the year around in those sections of the country where the winters are not severe; but as an extra precaution, a flexible glass substitute can be stretched across the interior from the tops of the four walls, thus providing a dead-air space above.



Cross section looking toward the end of the greenhouse and showing the steps beyond.

An Attic Shop Has Many Advantages

"WITH plenty of light and good ventilation, my attic shop is a very pleasant place to work in," wrote Frederick C. Hassold, of Mt. Airy, Pa., in the letter which accompanied this photograph. "I have spent many happy hours in this 13 by 15 ft. room, for a shop has been my hobby since boyhood days."



The well-lighted and neatly arranged shop of Frederick C. Hassold. An expert with the camera, he took this photograph himself.

The lathe, which has a circular saw attachment, and the tool grinder are motor driven. The scroll saw near the woodworking bench is a treadle machine that was given to Mr. Hassold as a Christmas present in 1880, yet it is still in good working condition. The rear of the shop, which is not shown, has a closet for wood and metal turning tools, shelves for supplies, and another window.

In concluding his description, Mr. Hassold added this comment: "As one of your old subscribers, I always look for POPULAR SCIENCE MONTHLY with much interest, and have gained a great many hints from its pages."

Photography is another hobby of Mr. Hassold's.

Graceful Wood Box for a Fireplace

By HENRY GEORGE

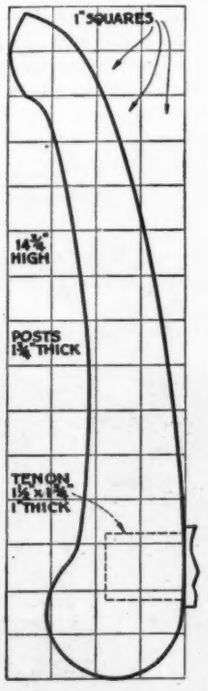
UNLIKE so many clumsy firewood boxes and racks, the one illustrated below will increase the charm of a fireplace, yet it is easy to construct. The design of the leg posts may be varied, if

A box or rack for firewood.

necessary, to suit the style of any room.

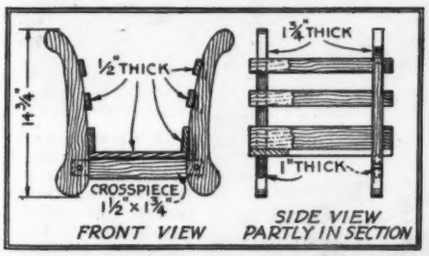
The size of the box is determined by the space it will occupy and the length of the firewood, the slats being made the same length as the firewood. If the length of the posts is increased, the mortise and tenon joints should be made longer for additional strength. Hardwood should be used.

Make a stiff paper pattern for the post, transfer the design to the stock, and cut out the posts with a band or compass saw. The rough saw-cut surfaces make an attractive finish; indeed, if it is necessary to trim them with an edge tool, roughen the surfaces afterwards with diagonal strokes of a coarse rasp.



The pinned mortise and tenon joints must be laid out for a driving fit.

If a natural finish is desired, several coats of linseed oil will enrich the wood and prevent seasoning cracks.



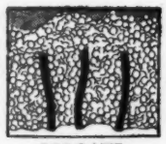
Working drawings of the firewood holder and a detail of the posts drawn to larger scale.

Small-bubble shaves last longer

Colgate's soaks whiskers soft at skin line. Razor cuts closer, smoother... your shave lasts longer.

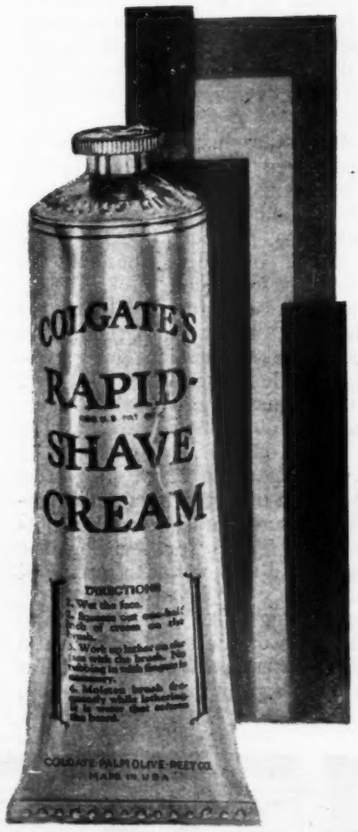
ORDINARY LATHER

This lather-picture (greatly magnified) of ordinary shaving cream shows how large, air-filled bubbles fail to get down to the base of the beard; and how they hold air, instead of water, against the whiskers.



COLGATE LATHER

This picture of Colgate lather shows how myriads of tiny, moisture-laden bubbles hold water, not air, in direct contact with the base of the beard, thus softening every whisker right where the razor works.



THERE is a vast difference between ordinary big-bubble lather, and Colgate's Small-Bubble lather... a difference in beard-softening efficiency.

Colgate's tiny bubbles seep down between whiskers, removing the oil film and *drenching* every hair with moisture ...*right at the base* where the razor works. Thus, your shave is closer... much longer-lasting.

The minute you lather up with Colgate's two things happen: 1—The soap in the lather breaks up the oil film that covers each hair. 2—Billions of tiny, moisture-laden bubbles seep down through your beard... crowd around each whisker... soak it soft with water.

A comparative test is easy—just mail the coupon, now. We will send, also, a sample of After-Shave, a new lotion... refreshing, delightful... the perfect shave finale.

FREE OFFER

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Grand Central Post Office, New York City

Please send me, FREE, the seven-day trial tube of Colgate's Rapid Shave Cream; also a sample bottle of "After-Shave."

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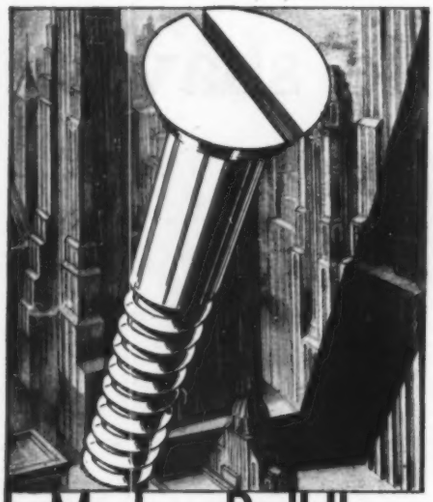

In Modern Buildings
Everywhere

In almost every great building that is constructed today you will find thousands of screws doing thousands of important jobs. And in the majority of cases you will find that the builder has selected American Screws.

American Screws can be counted upon to stay firmly in place—their deep cut, true running threads take care of this. They are easy to drive, too, because of their sharp gimlet points and strong bodies.

The new handy boxes of American Screws are on sale in leading hardware stores everywhere.

MADE IN THE UNITED STATES OF AMERICA

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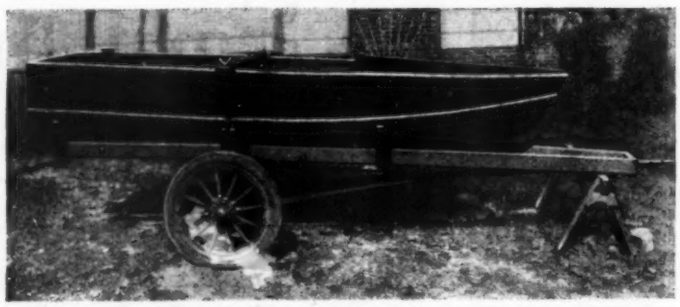
PROVIDENCE, R.I., U.S.A.
WESTERN DEPOT, 225 WEST RANDOLPH ST. CHICAGO, ILL.
"Put It Together With Screws"



The trailer ready for the road. It was built by Mr. Wood, a well-known writer on sports and outdoor life, at a cost of less than $15, except for tires.

An Easy Towing Boat Trailer

To Build One Costs Little If the Rear End of a Junked Automobile Is Utilized

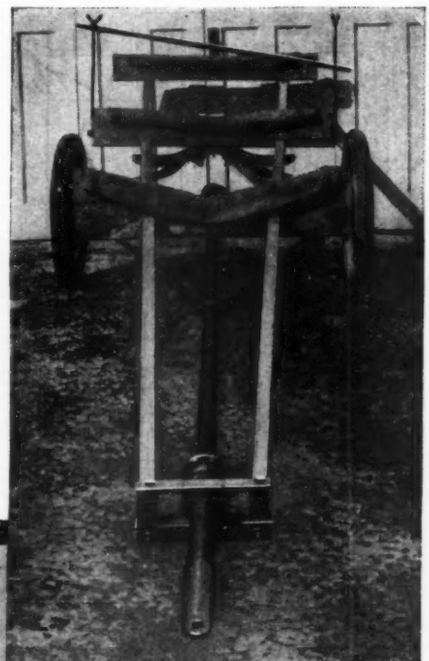
By DICK WOOD

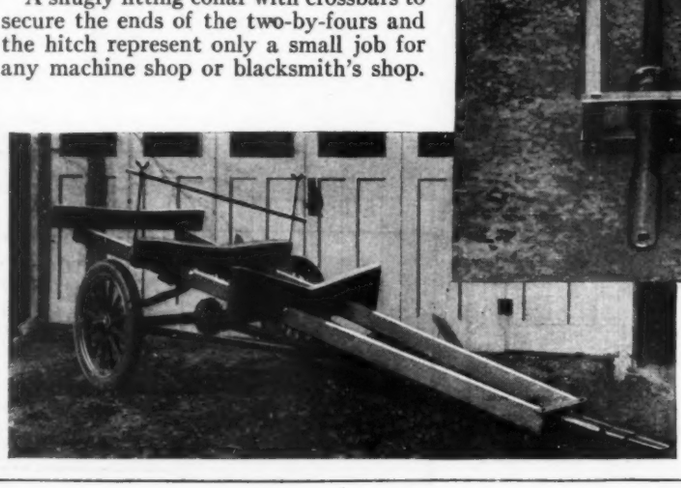
AN EXCELLENT boat trailer for a V-bottom boat can be made from the rear assembly of an old Ford car and a few dollars worth of lumber and bolts. Anyone who owns a small assortment of tools and knows how to use them should be able to finish the trailer in less than a day, with the exception of the hitch and collar device, which is a machine shop job.

The total cost, exclusive of tires, should not exceed fifteen dollars. The Ford parts may be bought from dealers in junk cars for about five dollars. In the accompanying illustrations, part of an extra drive shaft is shown, but this is because the trailer was made long enough for an 18-ft. boat; it is unnecessary for a trailer that is to hold a 12- or 14-ft. boat. Other materials needed are two straight-grain two-by-fours, 12 ft. long; one two-by-six 4 ft. long for the stern cross member; one four-by-four at least 69 in. long; one 2 by 11½ by 42 in. plank; one 4-ft. clamp strip of ⅞ by 4 in. material; two 22 in. long steel clamp rods with butterfly nuts and washers on the top ends and eyes at the bottom; two lag screws for securing the clamp rods; six 8-in. bolts with nuts; and two 6-in. bolts.

A snugly fitting collar with crossbars to secure the ends of the two-by-fours and the hitch represent only a small job for any machine shop or blacksmith's shop. This particular work cost the writer $4.50 at a local machine shop. The collar, an old bearing taken from a truck, was brazed securely, top and bottom, to two 12-in. strips of iron about ¼ in. thick. Each end of these cross strips was drilled to take the 6-in. bolts. This collar is to provide for the play created by the depression of the springs.

For a hitch on this trailer, a bar of iron ¼ in. thick and 2½ in. wide was welded into the torque tube; then a ½-in. hole was drilled in the end. Instead of this





The view above shows the crossbars and friction collar at the towing end; these provide the necessary flexibility. The framework is illustrated clearly in the photograph at left.

single arrangement, however, it is better to attach a good commercial coupler.

The 12-ft. two-by-fours are cut to length (that is, shortened if for less than a 16-ft. boat) and are laid across the spring cover in the position shown. A 46-in. length of the four-by-four is cut off and laid across the two-by-fours directly over the spring cover. This piece is drilled and bolted down through the center of the spring cover and leaves (three or four leaves are ample) and through each two-by-four.

BEFORE going further, patterns must be taken from the boat bottom; these can be made from 1 by 4 in. strips. They are placed across the upturned boat at the proper places and securely nailed together in the center. It is then a simple matter to mark the lumber and saw it to fit. A four-by-four 23 in. long may be sawed in such a manner as to make two pieces that will be a perfect fit for the bottom of the boat after they are secured to the main 4 by 4 in. base. The cut will depend on the pitch of the V-bottom.

The forward piece is made from the 2 by 11½ by 42 in. plank and is notched to fit the 2 by 4 in. supports. The stern piece is 2 by 6 by 48 in. and is not notched for the two-by-fours unless necessary. Both pieces are securely bolted to the two-by-fours.

The trailer, exclusive of hitch, need not be longer than 10 ft. for a 12-ft. boat, as the craft can extend 2 or 3 ft. beyond the rear support. If the boat bottom is straight, it is a simple matter to line up the three supports. After they are securely bolted, the edges should be rasped off; and several thicknesses of burlap padding may be tacked on with roofing nails.

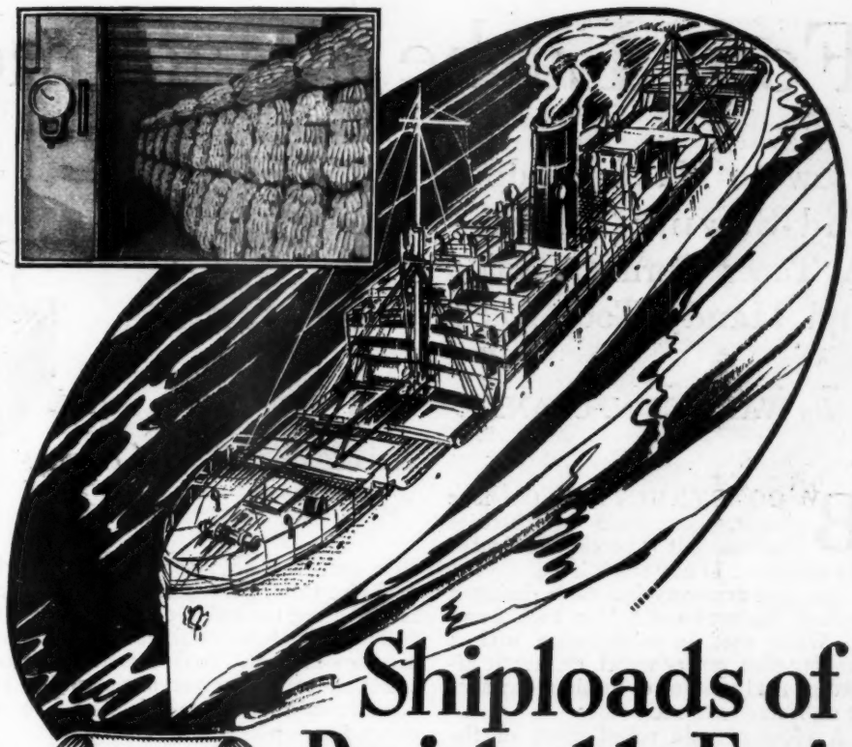
If the base frame is longer than 8½ ft., 4-ft. lengths of angle iron bolted to the underside of each beam will prevent any sagging of the rear support.

It is a simple matter to build in a box to hold accessories, or even a small outboard motor, just forward of the axle. In constructing a trailer of this sort, the builder should aim to get a little more weight forward than back of the axle, and this allowance should take care of the weight of a medium size outboard motor. Motors weighing more than sixty pounds should be detached from the boat before it is hauled.

Safety Conduit for Lamps

PRACTICALLY all table, boudoir, and similar electric lamps are held together by a piece of ordinary ⅛- or ¼-in. iron pipe. Because the thin silk-covered wire scrapes against the pipe, this construction is sometimes responsible for short circuits. And the hazard is doubled if the lamp is of all-metal construction.

Any home worker who has to repair a lamp can eliminate this possible hazard at an expenditure of less than fifty cents by substituting a piece of bakelite tubing of the same outside diameter as the pipe. If pipe fitter's dies are not available, almost any pipe fitter will thread and cut the tubing for a trifling charge. Scrape the inside of the tube at the ends to remove the burrs.—CHARLES R. WHITEHOUSE.



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NORTHWARD bound from West Indian and Central American Ports come the sturdy freighters of the lines engaged in the fruit trade. Each brings a cargo of some 5,000,000 bananas.

Left to the mercy of the radical climatic changes through which the boat must pass on its short trip from the tropics to the north, this valuable shipment might easily reach port spoiled and worthless.

But little, watchful instruments record the hold temperature so that proper refrigeration may be constantly maintained. Upon their absolute accuracy depends the safe arrival at the American table of this highly nutritious fruit.

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Four Lathe Attachments

How to Make Sanding and Sawing Tables—A Taper Turning Guide and Handy Tool Rack

By WARREN N. CRANE

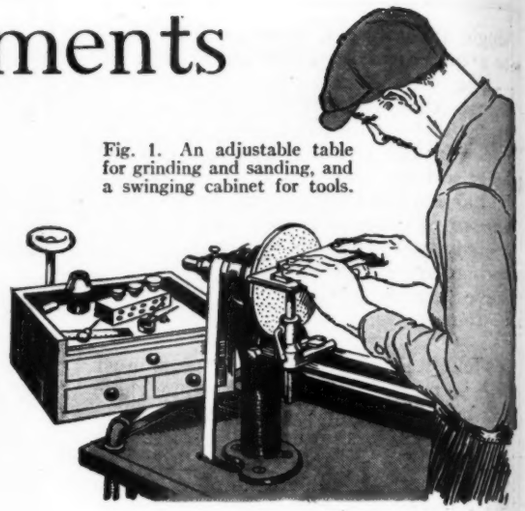


Fig. 1. An adjustable table for grinding and sanding, and a swinging cabinet for tools.

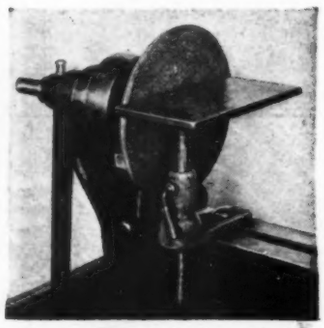


Fig. 2. This steel plate aids in obtaining perfectly square edges.

BY CONSTRUCTING the four simple, homemade attachments illustrated, it is possible to double the usefulness of any small lathe.

The first accessory is a table designed to fit in the hand rest holder, Figs. 1 and 2. When used in combination with a sanding disk, emery wheel, or saw, it affords a ready means of finishing surfaces at right angles to each other.

A piece of cold rolled stock of the proper diameter is fastened to a piece of flat plate (about 2 by 4 in.) by welding or by turning down a portion of the end and riveting it over into a countersunk hole in the plate. The top surface then should be faced off to make a good job, although it is not absolutely necessary if cold rolled plate is used and the riveting is smoothed up carefully.

The second attachment is a circular saw table made of steel as shown in Figs. 3 and 5. The slots at the front and sides are formed by riveting L-shaped pieces to the table proper. A number of holes are provided for the rear pivot rod so as to accommodate saws having various diameters.

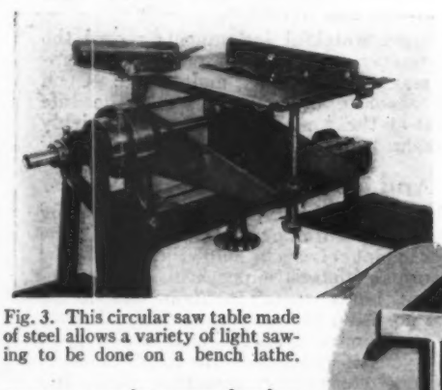


Fig. 3. This circular saw table made of steel allows a variety of light sawing to be done on a bench lathe.

Fig. 4. (*in oval*). A slide rest support for taper turning.

A wide throat piece should be made if wabble saws or dado heads are to be used. In mounting the saw on its arbor, use flanges of as large a diameter as possible and fairly thick, because they tend to make the saw run more smoothly through their flywheel effect; at the same time they reduce the noise by deadening the ring of the revolving metal. The flanges may be made of soft metal, such as "type metal" or babbitt, which will answer the purpose fully as well as steel.

Figure 4 illustrates the third device, which is used in turning long tapers on a speed lathe. After the ordinary type of slide rest has been set to the correct angle for turning a taper, it often must be moved along the bed to allow a longer cut to be made than was foreseen when the setting was made. To do this necessitates resetting to the proper angle, which is sometimes a tiresome job and allows errors to creep in.

The auxiliary rest support shown in Fig. 4 allows the angle to be maintained, and at the same time the rest is free to be moved in either a longitudinal or transverse direction before being locked in place.

The device consists of two T-shaped pieces, the shank of the upper member passing through the shank of the lower. Both shanks are threaded to receive locking nuts. The head of the upper piece is made to fit the T-slot in the slide rest, and the head of the lower to fit between the ways of the lathe. The fit must be as snug as possible and still permit an easy slide.

In use, the rest is adjusted to the required angle and the lower nut taken up tight: this locks the two T-shaped sections together, thus maintaining the angle. The rest may now be moved to any required position on the lathe and locked by tightening the upper lock nut.

By no means the least in value of the four accessories is the last one shown—the small tool cabinet of Figs. 6 and 7. In this case the idea was borrowed from the dentist, but it need not recall the same painful memories.

The cabinet can be made readily from almost any scrap lumber around the shop, together with one or two cigar boxes for drawers. The swinging arm can be built up of pipe fittings so that the cabinet can be turned to the most convenient position for the particular job in hand.

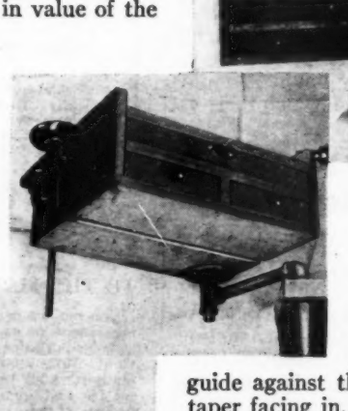


Fig. 6. (*at right*). View of the cabinet showing arm.

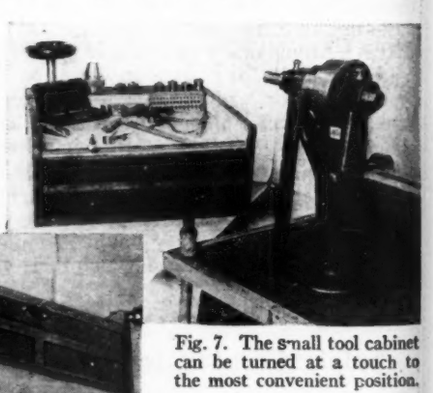


Fig. 7. The small tool cabinet can be turned at a touch to the most convenient position.

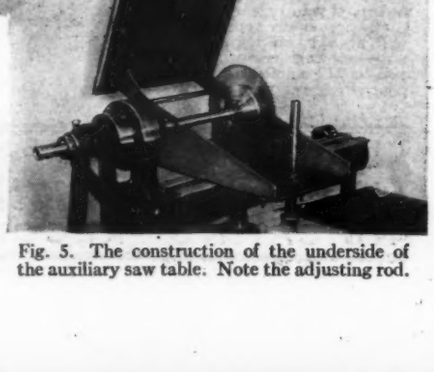


Fig. 5. The construction of the underside of the auxiliary saw table. Note the adjusting rod.

MANY times the home worker is confronted with the problem of sawing a taper on a piece of wood. This can be easily accomplished on the circular saw if a wooden guide is used.

On a board that is about 4 in. longer than the stock to be tapered and about 4 in. wide, mark off the required taper. Saw and plane the taper to the lines, and plane the opposite edge exactly true, using a hand jointer plane or a machine jointer.

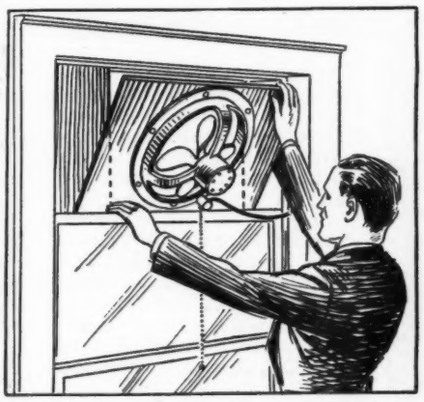
Place the wooden guide against the ripping fence with its taper facing in. Set the stock to be cut against the straight face of the guide and adjust the fence so that the stock is in the proper position for the cut desired.

If the taper is on stock that is to be used for a chair leg, it will be necessary to run the taper on all four sides. Saw the taper on two adjacent sides and then tack the waste wood back in place lightly, thus supplying a square guide face to allow cutting the taper on the other two sides.—W. CLYDE LAMMEY.

THE SHIPSHAPE HOME

Installing Kitchen Ventilators and Other Hints

HOT, stuffy, improperly aired kitchens are now as much out of date and as unnecessary as old-fashioned iron sinks or oil lamps. Ventilating units that give positive ventilation under all conditions can now be obtained and installed by any handy man. These and other electrical conveniences are described in the following discussion, which is a continuation of a series of similar Ship-



The new types of exhaust fans can be easily and quickly installed or taken down by anyone.

shape Home articles (P. S. M., Mar. '30, p. 120; Apr. '30, p. 118; and May '30, p. 122).

What are the best types of fans to obtain for ventilating a small kitchen?

The type in most common use is an exhaust fan which can be set with very little work in a window at the top, where it is out of the way and does not interfere to any great extent with the light. The other type is installed in the wall.

How is the window ventilator installed?

Manufacturers have various methods and supply full instructions with the units. In one popular design the unit is mounted on sheet steel arranged so that it can be fitted to windows of various sizes in the same manner as a sliding screen. The unit is put in place at the top of the window, the steel mounting is opened up until it fits exactly, and screws are driven into the window frame to hold it in place.

The electric cord is plugged into a near-by receptacle plug or wall bracket. If there is none near by, a new receptacle is installed especially for the fan. When turned on, the fan draws out the odors and hot air from the kitchen without causing a draft. An installation of a

EVERY surface in your home indicates your character to the searching eyes of your guests.

Walls and woodwork resplendent in an ever-attractive tint of *Kyanize* Celoid Finish always look well, wash easily and wear wonderfully. In *Kyanize* you will find a medium gloss, waterproof enamel finish in beautiful tints and white that *you* can easily use on walls, woodwork and furniture. Try its easy-brushing beauty now.

***Special Introductory Offer!*—Send one dollar and the name of your local paint dealer and receive a full-pint can of *Kyanize* Celoid Finish, a brush and the amazing *new* booklet in colors—"The Colorful Home." State color desired. Or send ten cents for book alone.**

BOSTON VARNISH COMPANY 357 EVERETT STATION BOSTON, MASS.

Kyanize
CELOID FINISH

ELECTRIC STARTING ON EVINRUDE Elto LOCKWOOD OUTBOARD MOTORS

SIMPLY touch a switch. Instantly your motor whirls . . . . . ten times faster than strongest human hands could spin it. Starting is immediate, positive. Start and stop as often as you wish, for the powerful 12 volt battery is automatically recharged. Have spot and running lights — have every boating convenience and luxury at amazingly low prices. Write today for catalog on your favorite outboard — Elto, Evinrude or Lockwood — all divisions of Outboard Motors Corporation.

OUTBOARD MOTORS CORPORATION
Ole Evinrude, Pres.
5570-27th St., Milwaukee, Wis.

Time Payments on Outboards

Under a new plan, Evinrude, Elto and Lockwood outboard motors may be purchased on easy terms, with down payments as low as $35 and six or eight months in which to square the difference. Full details may be procured by writing the Elto, Evinrude or Lockwood Division of the Outboard Motors Corporation at Milwaukee, Wis.

Sold by EVINRUDE Elto LOCKWOOD

WORLD'S lightest, handiest and most compact twin-cylinder outboard. *F-o-l-d-s* instantly to only 11½ x 13¾ x 17 inches. Tiller handle folds down to form comfortable carrying handle. Stow anywhere.

FOLD-LIGHT

Full 2¾ horse power, producing *efficient* speeds on canoes, rowboats, tenders. Twin silencers, self-steering, rubber cushioning of power head and many other remarkable features.

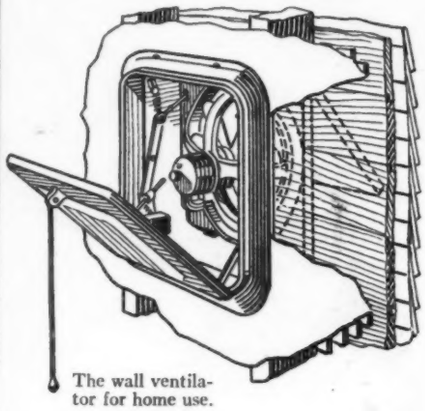
Write for catalog today.

Outboard Motors Corporation
Ole Evinrude, *President*
5570-27th Street Milwaukee, Wis.

fan of this type is shown on the preceding page.

How is the wall type of home ventilator installed?

A hole must be cut through the wall of a size to take the main casing of the unit. The thickness of the wall makes no difference. In the type of wall ventilator

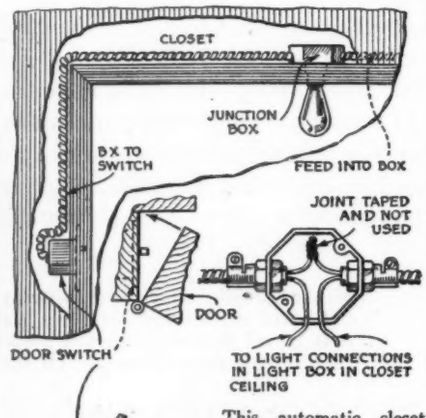


The wall ventilator for home use.

illustrated above, the act of opening the door automatically opens the outside shutter and also starts the motor.

How can an automatic closet light be installed?

The general scheme for installing an automatic door switch for controlling a closet light is shown below. The switch turns on the light when the closet door is opened, and shuts it off when the door is closed. It is installed in the inside of the door jamb, much in the same way as a mortise lock is cut in. The door bears against a plunger which projects from the switch. This plunger keeps the switch contact open as long as the door is closed; but when the door is opened, the pressure is released, the plunger



This automatic closet light switch turns on the current as soon as the closet door is opened.

springs out, and the switch contacts close.

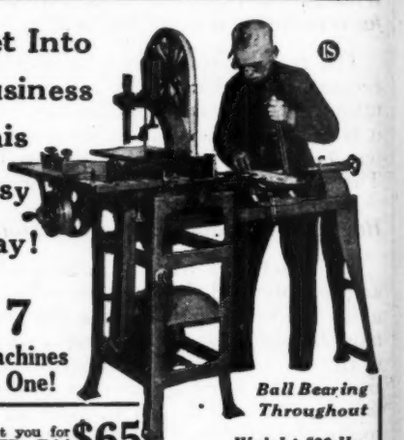
What is the simplest way to install a doorbell transformer and an extra light in the basement?

By means of a new combination bell transformer and cellar outlet illustrated

You can easily make cracked walls and ceilings good as new with Rutland Patching Plaster—the quick, money-saving mender. Just mix with a little water, then fill crack or hole. If you want a perfect, lasting job, be sure to ask for *Rutland* Patching Plaster—made by the secret Rutland formula that insures absolute whiteness and permanence. At paint, wall-paper and hardware stores. Rutland Fire Clay Co., Rutland, Vermont.

RUTLAND PATCHING PLASTER

Get Into Business This Easy Way!



7 Machines in One!

Ball Bearing Throughout

Weight 520 lbs.

Sent you for FREE Trial on deposit of $65 A whole year to pay.

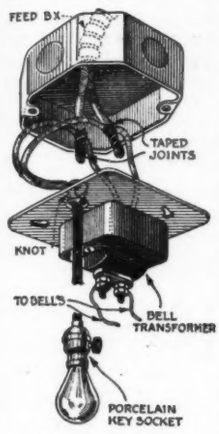
The Electric Carpenter

Make money on screens, trellises, furniture, toys etc. 8-in. Circular Saw; 14-in. Band Saw; 36-in. Lathe, 10-in. Swing; 6-in. Jointer; Reversible Shaper; ½-in. Hollow Chisel Mortiser; Sander. Does 35 Woodworking operations. NOT a toy.

Write Today for Illustrated Folder
We also build a complete line of single-purpose machines

The Woodworking Machinery Co., Inc.
250 N. 11th St. Phila., Pa.

below. In most basements, especially those used for home workshop purposes, an extra light is desirable, and a doorbell transformer is an inexpensive and foolproof accessory that replaces batteries. In installing this combination fixture, a standard junction box is used as a receptacle, and a short piece of BX cable is used to carry the line.



Combination makes one outlet do double duty.

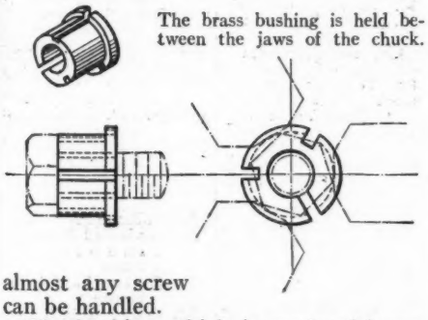
The bell wires are carried from the transformer to where the batteries are located, the latter are disconnected, and the new wires are connected to the bell system.

The names of the manufacturers of these articles can be obtained from the Information Department. —H. P. STRAND.

Bushing Holds Screw for Turning Operations

TURNING down and facing the heads and stems of screws of various descriptions is an ever-recurring job in any shop. While it is easy enough to do this work when the screws are long, it becomes a problem when they are short, and especially when it is necessary to face off the threaded end.

If an hour or two is devoted to making a set of ten or twelve of the type of facing bushing shown in the illustration,



The brass bushing is held between the jaws of the chuck.

almost any screw can be handled.

The bushing, which is made of brass, has a narrow flange in front to align it with the chuck jaws. The diameter of the opposite end is equal to the greatest diameter of the screw. This will generally be equal to the distance across the corners of a hexagon, U.S.S. cap screw. A convenient length for such a bushing is slightly more than the screw diameter, inasmuch as shorter screws are practically never used. One slit and two slots are milled lengthwise in the body as shown, so that a three-surface contact is made when the screw is placed in the bushing and clamped in the chuck.—H. S.

PREVIOUSLY painted walls can be done over in enamel by omitting any sizing coat and applying a half-and-half coat of enamel and flat paint, and the final coat of enamel.

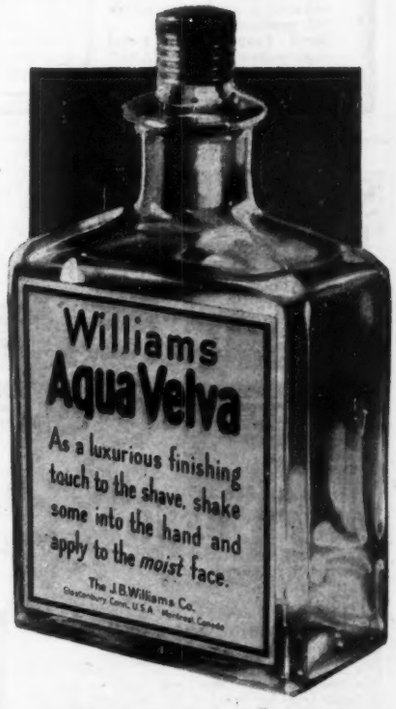
Start your day right by finishing your shave with

AQUA VELVA

Try this! When the lather is washed away, next time you shave, splash on Aqua Velva! Here's what you'll find.

First, **a sparkling tingle—livening—waking sleepy tissues. A real thrill that you'll look forward to each day!**

Then**—all day face protection. For Aqua Velva is scientifically blended to care for the newly shaven skin. Helps those tiny nicks and cuts, so many times unseen. Slightly astringent it makes for firmness of face tissue. And conserves the natural moisture of the skin so necessary to a good complexion.**


Williams
Aqua Velva
As a luxurious finishing touch to the shave, shake some into the hand and apply to the moist face.
The J.B.Williams Co.
Glastonbury Conn. U.S.A. Montreal, Canada

Aqua Velva gives a happy ending to the shave. That's where shaving happiness belongs. And its fine effects will stay with you all day long.

Aqua Velva is blended by the makers of Williams Shaving Soaps—Standard for 90 years. Together the Williams lather and Aqua Velva—Williams Shaving Service—are keeping millions of faces Fit!

5-oz. bottle 50 cents at all dealers, Or a Free Trial Size by addressing: Dept. PS20. The J. B. Williams Co., Glastonbury, Conn.—Montreal, Can.

Just notice the fine skins of men who use

Williams

Aqua Velva for after shaving

Will You Accept This
REMARKABLE RAZOR SHARPENER
FREE for 100 days

TWO AUTOMATIC MACHINES {HONE / STROP} IN ONE

ALLEGRO *Sharpens All Popular Type Blades*

It's no longer necessary to hoe and scrape your face when you shave. Use the ALLEGRO. The super automatic action of the two machines, which hone *and* strop the cutting edges on the diagonal, keeps the blade new, crisp and keen. ALLEGRO is the only sharpener equipped with a genuine hone and strop that provides for two distinct operations. Both are essential to the perfect shave, as any barber will tell you. But this scientifically perfected instrument (invented by a family of famous Swiss cutlers) hones and strops with still greater precision.

Saves Money—Even a new blade is not as good as an old blade that has been treated on ALLEGRO. You can use the same blade over and over again. Enthusiastic users write that they have gotten 300, 400 and more slick shaves from a single blade! Consider how much you will save in a year added to the great convenience. ALLEGRO is simple as A-B-C to operate . . . open construction, no bother. Packed in a handsome maroon leatherette case. (Complete for $4.85).

Unconditionally Guaranteed

Use ALLEGRO 100 days without obligation at our expense. If you're not entirely satisfied, send it back. We will return your money in full without a question. But you must try ALLEGRO to be really convinced of its wonderful merit. Send four dollars and eighty-five cents (4.85) as a trial order deposit.

Agents—Write at once for details of attractive money-making proposition. A great opportunity to earn big profits.

Allegro Co., Dept B30
170 Thomas St., Newark, N. J.

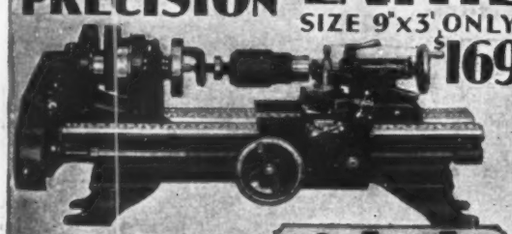
Send me an ALLEGRO { ☐ All Gillette Types ☐ Durham Duplex ☐ Auto Strop

at $4.85 each, complete with case. 100 day trial *Money Back Guarantee*

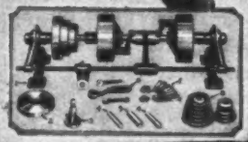
☐ Money order, or check enclosed
☐ Send C.O.D. (Few cents extra)

Name .....
Address .....
City & State .....
☐ *Mail descriptive literature only.*

Screw Cutting PRECISION LATHE
SIZE 9"x3' ONLY $169



New Model
SOUTH BEND
Junior Back Geared Screw Cutting Bench Lathe (size 9"x 3') complete with Countershaft and Equipment shown.



Free Catalog Shows All Sizes from 9 in. to 18 in.
Countershaft Driven Lathes, Motor Driven Lathes, Quick Change Gear Lathes, Standard Change Gear Lathes, Tool Room Lathes, Gap Bed Lathes, Brake Drum Lathes and Bench Lathes.

Prices of Popular Sizes of Quick Change Gear Lathes with Equipment

Size of Lathe	Shipping Weight	Countershaft Drive	Silent Chain Motor Drive
9" x 3'	490 lbs.	$294.00	$398.00
11" x 4'	725 lbs.	359.00	498.00
13" x 5'	1110 lbs.	443.00	602.00
15" x 6'	1550 lbs.	543.00	720.00
16" x 8'	2035 lbs.	638.00	817.00

WRITE FOR FREE CATALOG

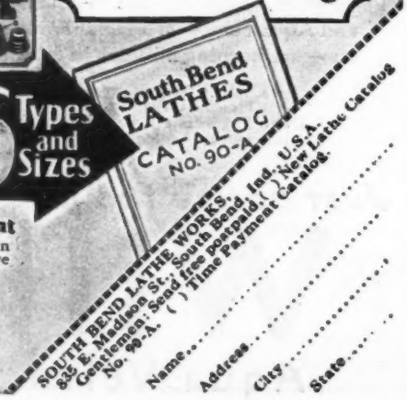
South Bend Lathe Works 835 East Madison Street South Bend, Ind., U.S.A.
Lathe Builders for 23 years—45,000 users

for the **Manufacturing Plant, Tool Room, General Repair Shop, Machine Shop, Service Station, Electric Shop, Engineering Shop, Maintenance Airport, Flying School and Laboratory.**

All on Easy Payments

We ship any South Bend Lathe immediately upon receipt of only 20 per cent of Catalog price. Balance in 12 equal monthly payments. Write for Time Payment Catalog. Ⓢ

96 Types and Sizes



SOUTH BEND LATHE WORKS, 835 E. Madison St., South Bend, Ind., U.S.A.
Gentlemen: Send free postpaid { } New Lathe Catalog No. 90-A. { } Time Payment Catalog.
Name.....
Address.....
City.....
State.....

BLUEPRINTS FOR YOUR HOME WORKSHOP

TO ASSIST you in your home workshop, POPULAR SCIENCE MONTHLY offers large blueprints containing working drawings of a number of well-tested projects. Each subject can be obtained for 25 cents with the exception of certain designs that require two or three sheets of blueprints and are accordingly 50 or 75 cents as noted below. The blueprints are each 15 by 22 in.

Popular Science Monthly,
381 Fourth Avenue, New York

Send me the blueprint, or blueprints, I have underlined below, for which I inclose.....
.....dollars.....cents.

Airplane Models

50. 36-in. Rise-off-Ground Tractor
69. Lindbergh's Monoplane (3-ft. flying)
82. 30-in. Single Stick
86. 35-in. Twin Pusher
87. 30-in. Seaplane
89-90. *Bremen* (3-ft. flying), 50c
102. Morris Seaplane (record flight 12½ min.)
104. Tractor (record flight 6,024 ft.)

Furniture

1. Sewing Table
2. Smoking Cabinet
3. End Table with Book Trough
5. Kitchen Cabinet
13. Tea Wagon
17. Cedar Chest
18. Telephone Table and Stool
19. Grandfather Clock
20. Flat Top Desk
21. Colonial Desk
24. Gateleg Table
31. Two Sewing Cabinets
33. Dining Alcove
36. Rush-Bottom Chair
37. Simple Bookcase
38. Sheraton Table
39. Chest of Drawers
49. Broom Cabinet
60. Welsh Dresser
68. Magazine-Rack Table
70-71. Console Radio Cabinet, 50c
77. Simple Pier Cabinet and Wall Shelves
78. Treasure Chests
88. Modernistic Stand; Modernistic Bookcase
91. Modern Folding Screens
93. Three Modern Lamps
100. Modernistic Book Ends, Book Shelf, Low Stand
105. Tavern Table and Colonial Mirror

Radio Sets

103. One-Tube (battery operated)
42. Three-Stage Amplifier
43. Four-Tube (battery operated)
54. Five-Tube (battery operated)
55. Five-Tube Details
79. Electric
80. Electric High Power Unit
81. Electric Low Power Unit
97. One-Tube Electric
98. Two-Tube Electric
99. Four-Tube Electric
109. Screen-Grid Set

Ship and Coach Models

44-45. Pirate Galley or Felucca, 50c
46-47. Spanish Treasure Galleon, 50c
48. 20-in. Racing Yacht
51-52-53. Clipper—*Sovereign of the Seas*, 75c
57-58-59. *Constitution* ("*Old Ironsides*"), 75c
61-62. Viking, 50c
63-64. 29-in. Toy Motor Boat, 50c
74-75-76. *Santa Maria* (18-in. hull), 75c
83-84-85. *Mayflower* (17½-in. hull), 75c
92. Baltimore Clipper (8 in. long)
94-95-96. Mississippi Steamboat, 75c
106-107. 42-in. Racing Yacht, *Sea Scout*, 50c
66. Ship Model Weather Vane
108. Scenic Half-Model of Barque
110-111-112. Schooner *Bluenose*, 75c
115-116-117. Concord Stagecoach, 75c
118-119-120. Covered Wagon, 75c

Toys

28. Pullman Play Table
56. Birds and Animals
67. Lindbergh's Plane
72. Colonial Doll's House
73. Doll's House Furniture
101. Fire Engine, Sprinkler, Truck, Tractor
113. Lathe, Drill Press, Saw, and Jointer
114. Airplane Cockpit with Controls

Miscellaneous

15. Workbench
26. Baby's Crib and Play Pen
30. Tool Cabinet, Boring Gage, and Bench Hook
65. Six Simple Block Puzzles

Price 25 cents each except where otherwise noted

Name.....
(Please print name and address very clearly)

Street.....

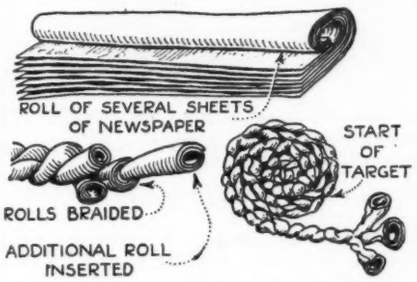
City and State .....

Ⓢ **This seal on an advertisement in POPULAR SCIENCE MONTHLY signifies the approval of the INSTITUTE OF STANDARDS. See page 8.**

Newspaper Used to Make Archery Targets

DURABLE and inexpensive archery targets can be made from old newspaper and scrap pieces of bag burlap.

Seven or eight full sheets of newspaper are first laid out on the floor and rolled into a tube 3 in. in diameter. Three of these tubes are prepared, tied together at one end, twisted once or twice to make them more compact, and then braided together in the familiar three-strand method. Another set of these tubes is made and each tube is slipped into each



The paper is rolled, braided, and wound spiral-fashion until the desired diameter is reached.

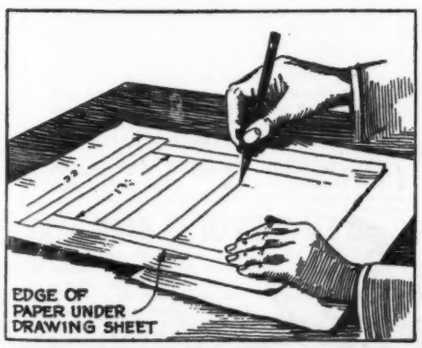
of the unbraided ends of the first set, and the braiding is continued. This process is repeated until sufficient braid is obtained to complete the target.

The target is made by rolling this paper braid in the same manner as rope is coiled on the deck of a ship. As the braid is coiled, the strands are sewed in place with grapevine cord. The thickness is governed by the thickness of the braid, which should be at least 6 in. If a burlap cover is sewed on the paper, it will improve the appearance of the target and will also help it to keep its original shape.—J. V. H.

Drawing Straight Lines Without a Ruler

STRAIGHT lines can be quickly drawn on bond paper or thin drawing paper without the aid of a ruler in the manner illustrated below. Merely place the sheet of paper on which you wish to draw the lines over the edge of another sheet and allow this edge to act as an invisible guide for your pen or pencil.

Free-hand lettering also can be guided in the same way.—WORTH STEWART.



Straight lines drawn in ink, as well as handwriting, can be guided by this simple method.

When Permanence is Needed

"Last summer we refinished some 1800 school desks and Plastic Wood was used to fill up holes cut through the tops. Several weeks ago I checked over the tops that had been refinished and it was almost impossible to tell those that had been filled with Plastic Wood. In fact, when it is hard it is harder than the wood itself."

From a School Official.

"We filled a hole one inch in diameter and one and a half inches deep with Plastic Wood. Two days later we inserted a screw in the hard Plastic Wood and when we tried to pry it out found that the Plastic Wood offered about the same resistance as the natural wood."

From a Woodworking Manufacturer.

"I filled in stone bruises in one of my golf clubs and faced it with Plastic Wood. It has not cracked nor chipped. Have even used it for tile and burnt places in hardwood floors."

Mr. E— S—

"The screens of our summer cottage were in pretty bad shape but instead of buying new ones my husband fixed them in A-1 condition with Plastic Wood."

Mrs. J— D—

"Then I used Plastic Wood to fill some holes where a telephone had been removed. After it was sanded and finished it is difficult to tell where the holes were."

Mr. W— A—

PLASTIC WOOD

Reg. U.S. Pat. Off.

Handles Like Putty ~ Hardens Into Wood

Letters such as those quoted above are constantly coming unsolicited to our offices. We can only guess at the thousands of practical daily uses to which Plastic Wood may be put. We know that it holds lastingly to any clean, dry surface; that it is waterproof and greaseproof; that it will take paint, lacquer or varnish perfectly; and that when hard it can be worked with tools and will not split, splinter, chip, crumble or disintegrate. It costs little to try—it may save many dollars on household and industrial repairs.

Plastic Wood (and Plastic Wood Solvent for softening Plastic Wood and cleaning the hands and tools after using) is carried in natural wood, mahogany, walnut, oak, cedar and other colors by Hardware and Paint Stores.

Tubes 25 cents **¼ lb. can 35 cents** **1 lb. can $1.00**

Solvent—25 cent and 50 cent Cans

***Manufactured by* ADDISON-LESLIE COMPANY**

328 Bolivar Street, Canton, Mass.

SPECIAL INTRODUCTORY TRIAL OFFER

Send for Sample Package

The Strongest Adhesive Known

Try CASCO where other glues have failed.

CASCO holds permanently in any climate . . . on exterior or interior work . . . because it is *Waterproof*.

CASCO is a dry powder which mixes easily in cold water.

NO HEATING—NO ODOR—NO WASTE

It gives a glue-joint *stronger than the wood itself*.

CASCO glues practically everything—wood to wood, metal, glass, cardboard, leather, cloth or paper—and glues it to stay.

Buy CASCO from your hardware, paint or lumber dealer.

Trial Box . . .	10c
½ lb. Can . . .	40c
1 lb. Can . . .	65c

Also supplied in 5 and 10 lb. Bags.

If not obtainable locally, remit as above and we will send direct, postpaid. Fill out completely the coupon below for a trial package.

DEALERS—*Send for Sales Plan.*

MANUFACTURERS—*Consult us on your glue problems.*

The Casein Manufacturing Company of America, Inc.
205 East 42nd Street New York

THE CASEIN MANUFACTURING COMPANY OF AMERICA, INC.
205 East 42nd Street, New York

Enclosed find 10¢ (stamps only) for which send me your trial package of CASCO WATERPROOF GLUE.

Name .....
Street .....
City ..... State .....
Hardware, Paint or Lumber Dealer's Name (Please include)
.....

D630

HOME WORKSHOP CHEMISTRY

BY THE application of a few simple yet dependable tests, the discriminating home worker can choose a good grade of lacquer.

The *spray test* is used to determine the quality of spraying lacquer. To perform this test, dilute the lacquer with thinner to the right consistency and then adjust the spray gun to deliver a fine mist. Spray a cleaned 24 by 30 in. tin panel and, as the panel is drying, examine it carefully for rough spots resembling the outside of an orange peel.

If it is necessary to use the lacquer in a cold or damp place, its resistance to blushing or whitening is important. In this case, spray the panel under the same conditions in which the actual work will be done and then, after an hour's drying, examine carefully for white spots. A first-class lacquer should neither roughen nor blush.

The presence of the correct amount of plasticizer is determined by the curling test.

The *brushing test*, which is used on types of lacquer that are applied with a brush, forecasts the effect of the lacquer on the old, underlying coat of stain, paint, or varnish on a previously finished piece. An old mahogany stained chair leg and a board covered with old varnish furnish ideal surfaces for the test.

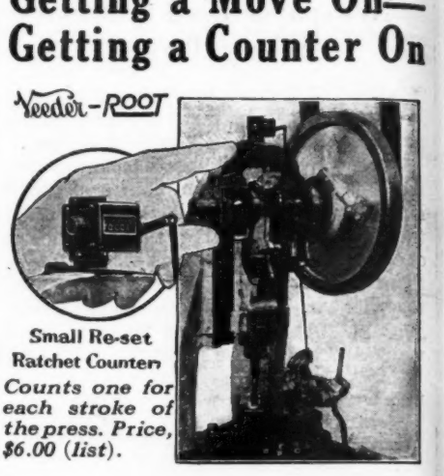
First, scrub the surfaces with gasoline and allow them to dry. Then apply the lacquer to both types of surfaces in rapid strokes with a well-filled brush.

After the work has dried, examine it for the following defects: First, lack of smoothness; second, particularly on the varnished board, blisters caused by the softening and raising of the underlying coat by the solvent in the lacquer; and third, a defect technically called bleeding, which should be looked for on the stained chair leg. Bleeding is a disfiguring stain in the lacquer due to the color of the old mahogany coat, which is dissolved in the solvent of the lacquer.

The test for corrosive and acid properties should be made on any lacquer which is to be used on metal. These damaging

Getting a Move On—Getting a Counter On

Veeder-Root



Small Re-set Ratchet Counter
Counts one for each stroke of the press. Price, $6.00 (list).

Work at machines, or work *on* machines will move without a Counter. Development-work or production—just moves!

The matter of "getting a move on" production is largely a matter of getting a Counter on your machine.

Nothing but work or actual *output* moves the figure-wheels of a Counter. That's why the output moves steadily *Up* when you require that it register on the Counter. *Ask for Catalogue.*

Veeder-Root INCORPORATED HARTFORD, CONN.

OFFICES IN PRINCIPAL CITIES: WRITE OR PHONE

WOLLENSAK MICROSCOPE
$16.50
MADE IN U.S.A.

The most interesting things in nature are hidden from the unaided eye. Insect, plant, and mineral life have thousands of fascinating mysteries that can be perceived only by means of a microscope. One of these fine WOLLENSAK Microscopes should be in every *home, office, school, or laboratory where students, dentists, physicians or scientists* can spend many hours in interesting and instructive research. The WOLLENSAK Microscope offers a range of magnification from 100 to 250 diameters in steps of 25. Elaborately finished, nickel trim, tilting stand, plush-lined case, prepared slide, and complete instructions. If your dealer can't supply you, we will send you one postpaid. *Money back guarantee.* Lower-powered WOLLENSAK models $2.50 to $8.50. Catalog free.

WOLLENSAK OPTICAL COMPANY
870 Hudson Avenue Rochester, N.Y.

SAMPLES OF 33 RARE WOODS
20 cabinet woods $1.00. Sets labeled and postpaid. Send 5c stamp for 16 page illustrated catalog showing 16 different things to make. Catalog lists blue prints, all kinds of lumber panels, veneers and inlay woods
ONLY $1.00
CRAFTSMAN WOOD SERVICE CO.
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properties can be caused by the presence of sulphur compounds in the lacquer solvent or from the decomposition of the nitrocellulose in the lacquer itself.

To make the test, cut and polish a ½ by 6 in. strip of sheet copper and place it in about half a cup of the lacquer. Stand the cup and strip in a warm and well-ventilated place, as outdoors in the sun, for an hour or two and replenish the lacquer as it evaporates. Corrosive sulphur compounds are betrayed by brown stains on the copper, while acid causes a green discoloration in the liquid around the metal.

It is the nature of nitrocellulose to curl and wind itself into a knot. To control this tendency, the lacquer makers have added materials called plasticizers, which in the better grades of lacquer wholly

The lacquer film is detached from the panel and tested for strength and flexibility.

eliminate the tendency of the lacquer to pull away from its base.

The test for the proper amount of plasticizer in a lacquer is called the *curling test*. Procure from a stationery store a 6 by 8 in. card of the grade known as "velvo." Apply the lacquer to this card and dry it under the same conditions as those under which the actual work will be done. Lack of plasticizer evidences itself by a pronounced curling of the edges of this card after the lacquer has dried.

A good way to ascertain the strength and flexibility of different brands of lacquers is to remove the dried films from their test panels. This can be done in the following way: Tin plates are cleaned and then amalgamated by rubbing a drop of mercury over them with a soft rag. The excess mercury is rubbed off and each panel is sprayed with a different lacquer. Allow these to dry in a nearly vertical position.

At the end of four hours remove the lacquer films by carefully running a knife blade around the edges and then peeling the material off. A good film will be flexible, even in color, smooth surfaced, and strong enough to resist a considerable tearing pull exerted with the fingers. If the same amounts of lacquer, all properly thinned, have been applied to the different panels, the strongest and toughest of the samples will be the one whose film offe s the most resistance to the tearing test. This test, however, should be applied as soon as the film is removed from the panel.—W. H. HAMMOND.

ATKINS SILVER STEEL SAWS

for YOUR Home Shop

You'll Have More Fun—Do Finer, Faster Sawing!

HALF the fun of making things in your home workshop, is in being able to cut wood or metal quickly, easily and accurately. A poor saw not only takes all the joy out of the job, but spoils material and wastes your time and money.

But what a difference there is when you use a really fine saw—an ATKINS! Its Silver Steel blade sings its way across the wood with amazing speed and ease, leaving a clean, smooth cut that any expert would envy.

For EVERY sawing job in your home shop—cross-cutting, ripping, mitering, tenoning, jointing, dadoing, band sawing, etc.—there is an ATKINS Silver Steel Saw to help you do the work faster, easier and better.

Circular Saws for your electrically-driven hand or bench machines. Dado Heads to cut grooves. 36 different Hand Saws, headed by the famous "400" series, "Finest on Earth," The "Home Builder," or "Junior Mechanic" for boys who want a good hand saw! Back Saws, Coping Saws, Compass Saws, Keyhole Saws, and many others.

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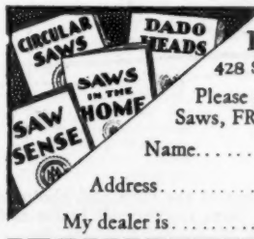
Ask for an "ATKINS" at your Hardware Store, when you buy any saw. Send coupon for the helpful booklets offered FREE below.



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Go to your Indian dealer today . . . ask for a demonstration. He'll be glad to show you the new improved Indians. Take your pick . . . kick over the motor, settle down in the spring cradled saddle, give it the gas—listen to the punching power that throbs from its motor. Take it out on the road . . . test it for easy steering, for snappy getaway, for almost instant stopping. One ride will convince you. ¶If there is no Indian dealer near you, write us for further information. If you are interested in becoming the Indian dealer in your territory, state this when you write.

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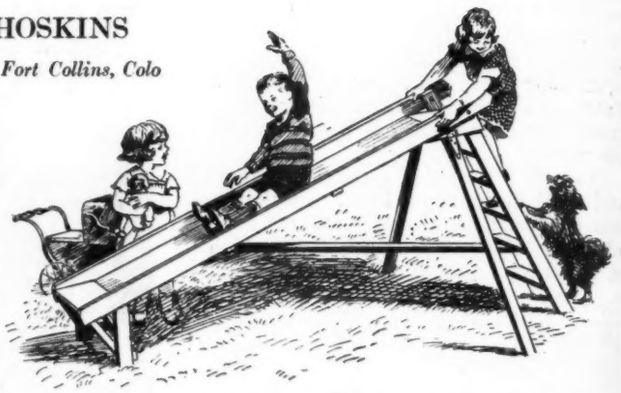
You Can Make a Playground of Your Yard by

Building a Child's Slide

By JAMES A. HOSKINS

Director of Industrial Arts, Fort Collins, Colo



The slide, because of its side bracing, is particularly stable and safe, and its size allows it to be used indoors as well as outdoors.

SMALL children find endless fun in a slide, which is always one of the most popular pieces of playground apparatus in city parks and school yards. They will get just as much enjoyment from a small slide set up in their own back yard or garden.

The sturdy slide illustrated may be made in any home workshop at a minimum cost, since lumber of standard size is used throughout. The materials needed in the construction are as follows:

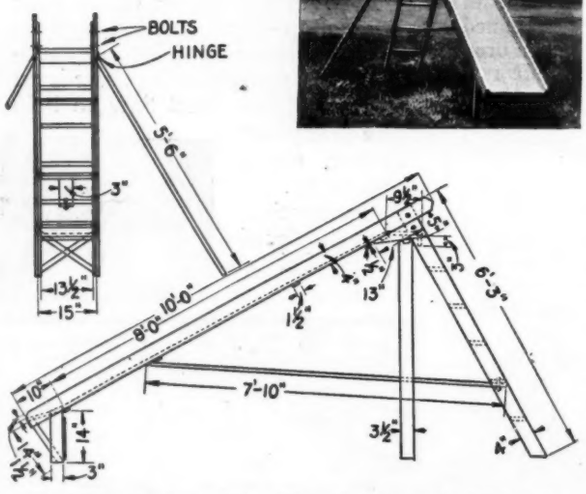
3 pcs. ¾ by 6 in. by 8 ft. for bottom
2 pcs. ¾ by 4 in. by 10 ft. for sides
1 pc. ¾ by 4 in. by 7 ft. 10 in. for brace
2 pcs. ¾ by 3½ in. by 5 ft. 6 in. for side braces
2 pcs. ¾ by 4 in. by 6 ft. 3 in. for sides of ladder
5 pcs. ¾ by 4 by 13½ in. for steps
3 pcs. ¾ by 1½ by 16½ in. for cleats
2 pcs. ¾ by 5 by 13 in. for top braces
1 pc. ¾ by 9½ by 15 in. for top step
2 pcs. ¾ by 3 by 14 in. for bottom leg
2 pcs. ¾ by 1½ by 14 in. for bottom brace
2 pcs. ¾ by 1½ by 21 in. for bottom brace
1 pc. ¾ by 10 by 15 in. for end of slide
5 carriage bolts ¼ by 1¾ in.
16 F H B screws 1¼ in. No. 10
2 F H B screws 2 in. No. 10
1 pair 2-in. hinges

The objection to many small slides is the possibility of their upsetting, but in this design the side braces eliminate that danger. The height and slant are so planned that there is little likelihood of accidents. Furthermore, the slide is small enough to be used in the garage or playroom, and it can be folded up when it is necessary to move or store it.

The ladder is bolted to the slide with two bolts placed on each side at the top, and the cross brace at the bottom is bolted to the ladder and screwed to the underside of the slide. When the cross brace is removed, the ladder folds up and fits into the slide. The side braces are hinged to allow secure bracing on uneven ground.

The floor of the slide should be made of tongue and groove material, glued with waterproof (casein) glue and well clamped together. When this is planed and thoroughly sandpapered, it will give an excellent sliding surface. The floor is well reënforced by screwing four cleats to the bottom; these pieces should extend to the edge of the side rails. The steps on the ladder are either butt-nailed in place or housed into the upright sidepieces.

When the slide is completed, all but the floor should be given two coats of good outside paint to harmonize with the surroundings. Red and green are attractive and serviceable colors. The floor should be given one coat of shellac and two coats of spar or outside varnish. This will provide a smoother and more lasting surface than paint. If older children are to use the slide, the floor of the slide may be waxed.

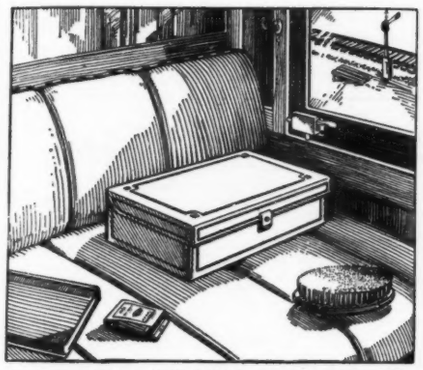


Side and rear views of the slide and photograph showing the completed slide. Note the two side braces and the cross brace.

TO JOIN new cement to a section laid the day before, wash the surface well and paint it with cement and water mixed to a creamy consistency. This will make a bond.

Leather Traveling Case Made at Low Cost

By F. CLARKE HUGHES



Large enough to hold toilet necessities but small enough to fit into the smallest traveling bag.

FOR the man or woman who travels, the sole leather case illustrated above is an article of genuine utility. It is large enough to accommodate the usual comb, brush, and other incidentals and at the same time is small enough to fit snugly in the corner of even a small traveling bag.

The materials and tools needed for the construction of the case are: a piece of sole leather, some good quality linen thread, a block of wood the same size as the inside of the box, two large sewing needles (preferably bent), an ordinary awl, and a tooling iron. The latter can be made from an old flat file as illustrated in Fig. 1.

The leather, which should be ⅛ in. thick, can be purchased from the neighborhood shoemaker or from any large leather or harness shop.

While the dimensions can be varied to

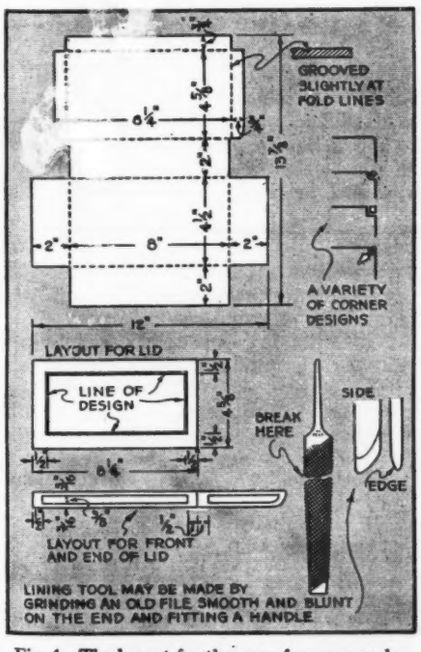


Fig. 1. The layout for the case, four corner designs, and a suggestion for the tooling iron.

This Summer... Motor on Water at Motor Car Speed

These Electrically Started Outboards take you anywhere—LOGS, ROCKS, SNAGS, SHOALS—nothing can stop their tilting propellers

YES, cutting the waves at motor car speed, not only in waters already navigable, but through shoals, lakes, and winding streams too full of obstructions or too shallow for inboard motor boats to venture.

All these are now unlocked to camping, fishing, cruising and exploration by these new fast, invincible craft—Johnson Complete Outboard Motor Boats—powered by silent Sea-Horse Motors.

This year Sea-Horses offer electric-starting optional on models "32," "24," and "16." They have the famous Vacturi Carburetor that increases speed by 200 to 300 r. p. m. reduces fuel consumption by 20% to 30%.

Alternate firing cylinders in Sea-Horses "4" and "12" bring effortless starting by doubling the number and intensity of the sparks. They have quiet Underwater Exhaust and Full Pivot Steering—so you can maneuver quickly or reverse instantly.

Sea-Horse motors are undisputed speed champions. They hold more official 1930 records than all other makes combined.

Matched to Sea-Horse motors come the new Johnson Fleet of luxurious boats—smart colors and revolutionary seamless watertight Sealite construction, 50% lighter in service, 35% stronger than usual construction and guaranteed to outlast it.

Johnson Matched Units include the new type electric-starting Aquaflyer. It starts, steers, and throttles like a motor car—combines speed, beauty and carrying capacity of a costly inboard—yet interior has 30% more usable room because motor is located outboard in a covered stern-hatch.

Send your address at once for free beautiful color-illustrated Boat and Motor Catalog with prices, and descriptions of all models.

All dealers carry first-aid service parts. Sales and service stations in all parts of the country. Partial payment terms.

JOHNSON MOTOR CO.
2593 Pershing Rd., at the Lake, Waukegan, Ill. . . *In Canada:* Canadian Johnson Motor Co., Ltd., Peterboro, Ont. *World's Largest Manufacturer of Outboard Motors and Matched Units*

Sea-Horse Single—only 27 lbs. Full Pivot Steered, $125. All prices f. o. b. factory.

Electric-starting Sea-Horse "32" $395; Rope-starting $325

Monarch of outboards, class D, 4 cylinder, one of the three Sea-Horses now offered with electric-starter and auxiliary rope-starter or with rope-starter only.

Johnson Boats $145 Upward

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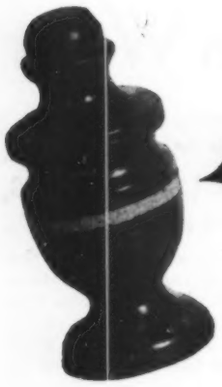

INLAID WITH SAVOGRAN CRACK FILLER

Read what an enthusiastic user says about Savogran Crack Filler:

"In these days of Home Craftsmanship in wood turning and wood working, where the slip of a tool may spoil an otherwise perfect job, it is gratifying to know that Savogran Crack Filler restores its original shape.

"To demonstrate one of its many uses in the Home Workshop I am enclosing a piece of black walnut (illustrated) that I have turned and inlaid with a band of Savogran Crack Filler in natural wood color for contrast.

"It also repairs wooden patterns damaged from use in the foundry, saving many times the price of a new pattern. I must say that its uses are more than I anticipated."

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HAVE YOU A WORKSHOP?

IF you like to work with tools, get acquainted with Savogran Crack Filler. You'll find it the handiest material you've ever used. It has a thousand uses—for building furniture, models, and toys—for clever inlay work, building up chipped and damaged edges on your work—there's nothing like it. There's a fascination in finding new ways to use Savogran Crack Filler. And it will pay for itself over and over again doing odd repair jobs around the house.

Savogran Crack Filler *won't shrink!* Press it into place—it hardens quickly and the job's done for good. Takes paint, lacquer, or varnish perfectly. And after it's painted it defies detection — *permanently.*

Get a can of Savogran Crack Filler today from your hardware or paint store. Use it just once and you'd just as soon give up your hammer as be without it.

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Don't throw them away. Soak them in Painters' Savogran—they'll come out good as new. Painters' Savogran cleans like magic—removes paint and varnish. Indispensable if you do any painting.

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35-lb. all-metal pail (for large users) $7.70; 5-lb. can $1.25; 1-lb. can 30c. No hardening in the can—the biggest value on the market.

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is a combination Mannheim, Polymetric, Log-Log, Binary, Add and Subtract Slide Rule. It will instantly add, subtract, multiply and divide any combination of whole numbers, fractions, mixed numbers and decimals. Gives every root and power, also Logs, Sines and Tangents. Made of aluminum with scales on white celluloid. Size 4 in. Approved and adopted by colleges. Price with instructions, $1.50. Fabricoid Case 50c extra. Sent C.O.D. if desired. Catalogue Free. GILSON SLIDE RULE CO., Stuart, Florida

(Patented 1-17-22)

Oil Filling Pipe Cap

Cap does not contain screens, packing, filtering material or moving parts.
Whirlo allows free escape of crankcase gases but no flying particles of oil can get by—they are collected and returned to the crankcase.
It fits FORD "A" perfectly—just slip it on. Nothing to get out of order. Rigid, scientifically designed, money back if not satisfied.

KEEP OIL WHERE IT BELONGS--IN THE CRANKCASE!

Without the Whirlo Cap you are spraying oil all over the outside of the motor. Oil rots hose connections—ruins ignition cable—draws grit and dirt into vital working parts—makes the motor old before its time. Tiny particles of oil are constantly being blown out through the breather pipe. They collect on all surfaces to form a dirty, greasy slime that is definitely harmful to generator, starter motor and all parts of the ignition system. Give your motor a chance—protect it—get rid of oil slime. The Whirlo Cap keeps oil where it belongs—in the crankcase. Costs only $1.00—saves in price many times over in rotted hose connections alone. Send no money. We mail it C.O.D. $1.00 plus few cents postage.

CARHART PRODUCTS
36-48 Flatbush Ave., Ext. Brooklyn, N. Y.

suit the taste of the worker, it is advisable to lay out the box with extreme care before purchasing the stock.

When you are sure that your calculations are correct, buy the necessary leather, and then lay out the form on the inside of the leather, being careful to see that the best portion of the stock is available for the lid.

The cutting may be accomplished with an ordinary knife. When the leather has been cut to shape, a small groove should be cut along all of the bends in order to make folding possible (Fig. 1). This can

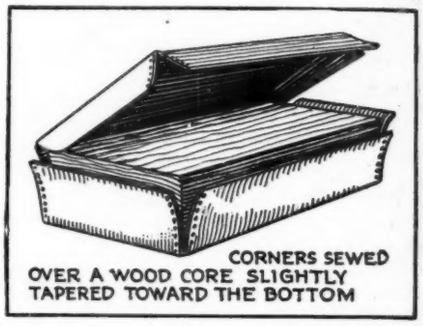


Fig. 2. The leather should be thoroughly wetted before the sides are bent over the wood block.

be done with a wood carver's gouge or with the point of a knife.

Next lay out the exact positions of the stitches, placing them 1/8 in. from the edge and 1/16 in. apart.

The wooden form used in the sewing operation should be tapered slightly in order to make its removal easy (see Fig. 2).

Moisten the leather thoroughly and bend it around the wooden form as in Fig. 2. Wax the linen thread with beeswax and proceed with the sewing. The needles should be placed so that there is one needle on each end of the same thread. The proper method is as illustrated in Fig. 3. The holes are made with an awl as they are needed.

The two front corners of the lid may be sewed over the box itself, which will serve as a form.

The decorations, four suggestions for which are shown in Fig. 1, are done with a tooling iron, which can be made from an old flat file as previously suggested.

Lay the design out first in pencil, moisten the leather, warm the iron, and then draw it along the lines of the design. The

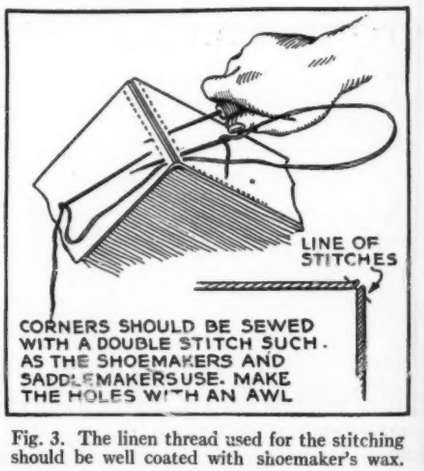


Fig. 3. The linen thread used for the stitching should be well coated with shoemaker's wax.

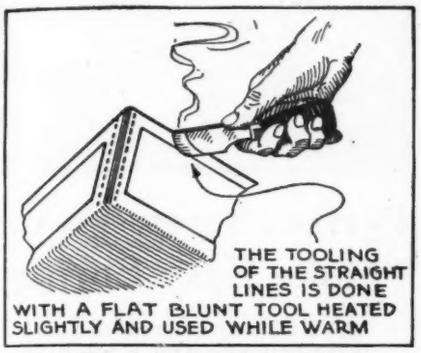


Fig. 4. The wooden form block should be kept in place during the entire tooling operation.

tooling should be done with the form block in place (see Fig. 4).

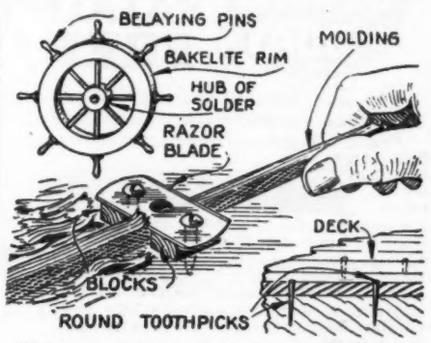
Any simple form of latch or lock can be used. These can be obtained in various types and sizes at any large hardware store.

After the latch has been fastened in place, wax the entire box with shoe dressing or other wax. If desired, the inside of the box may be lined and partitioned to suit the needs and taste of the user.

Three Timesaving Kinks for Ship Model Makers

STEERING wheels for ship models can be made from a small piece of bakelite, lead, or solder, and eight small belaying pins.

The rim of the wheel, whether formed of bakelite or metal, is cut to an outside radius equal to the length of a pin to the shoulder. Divide the rim into eight parts, and drill holes the same diameter as the pins and along radial lines to the



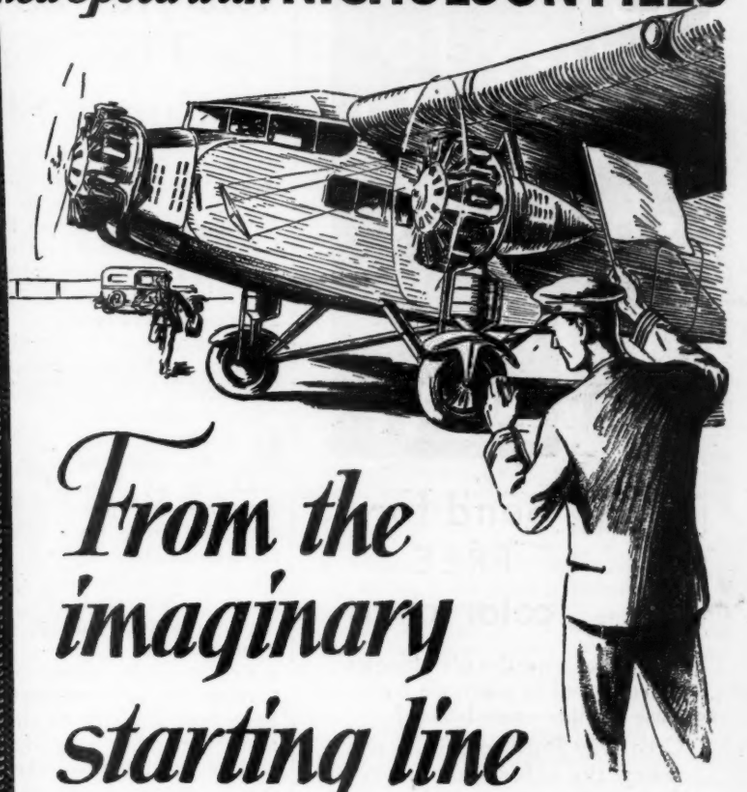
Making a steering wheel, shaving molding to shape, and using toothpicks instead of brads.

hub. The pins are inserted and joined at the hub with a drop of solder.

Molding for models can be quickly brought to shape by the application of the simple kink illustrated. The cutter consists of a razor blade fastened to the top of the bench with blocks inserted between the blade and the bench so as to raise the blade the desired distance. Cut the molding roughly with a penknife and draw the strip through as shown.

If round toothpicks, instead of nails, are used along the deck, it is possible to improve the finished appearance of any model. Drill a hole slightly smaller than the toothpick, insert the toothpick in the hole, and cut it off neatly flush with the deck.—WILLIAM HENNING.

Sustained Speed with NICHOLSON FILES



From the imaginary starting line

AT the drop of the starter's flag, the transport plane must leave its imaginary starting line and maintain a speed of anywhere from eighty to a hundred miles an hour, to make its run on scheduled time.

Sustained filing speed is just as important to the mechanic as sustained flying speed is to the pilot.

For sustained filing speed, use Nicholson Files. The shape of their teeth gives extra service, the temper of the special file steel means longer life.

You can get Nicholson Files in many shapes and sizes from your hardware or mill supply dealer.

NICHOLSON U.S.A. (TRADE MARK)

NICHOLSON FILE CO.
Providence, R. I., U. S. A.

—A File for Every Purpose

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Send for FREE color chart

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Creo-Dipt Brushcoat Stains will renew the color and preserve them against rot and decay.

Easy to apply—one brushcoat is usually sufficient. Inexpensive. Come in all the rich soft shades that have made Creo-Dipt Stained Shingles famous for their lasting beauty.

Ask your lumber or paint dealer abou Creo-Dipt Brushcoat Stains . . . how little they cost. Mail the coupon.

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1620 Oliver Street, North Tonawanda, N. Y.

I am interested in Creo-Dipt Brushcoat Stains for old shingles. Please send me free illustrated booklet and color chart.

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'Way Over Housetops!

Model No. 22

Get real fun and thrilling flights. The Kingsbury *Silver Arrow* actually flies! Launches by hand or "takes off" from ground. Long, continuous flights assured. Not a construction toy but fully built. Ready to fly in a moment. Made of Balsa wood and aluminum; aluminum cabin, propeller; adjustable wings; strong elastic motor. Model No. 22, Cabin Type, Wing spread 26 in., $2.50. (West of Miss., $3.85.) Other models, Racing and Cabin, at $1.00 to $3.50. If your dealer cannot supply you, send your order to us. Kingsbury Mfg. Co., 107-F Myrtle St., Keene, N. H.

Join the Silver Arrow Flying Club and become a Master Pilot.

KINGSBURY *MOTOR DRIVEN* TOYS

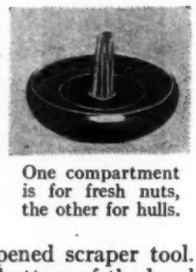
FREE! Novelty Moviescope; shows motion picture of Silver Arrow flight. Also complete toy catalog.

Send 10c for a Kingsbury Disc Wheel, Balloon Tire Eraser, Set of 4, 35c

This Nut Bowl Has a Place for the Empty Shells

WITH its two compartments, the outer for fresh nuts and the inner for empty shells, the nut bowl illustrated forms an attractive and useful piece for decorating the dining table or sideboard, and it is also an excellent problem for the amateur wood turner.

While almost any evenly-grained piece of stock can be used, mahogany or walnut is preferred because of its fine appearance when finished. Fasten a 3 by 10½ by 10½ in. piece of stock to an 8-in. faceplate and proceed by turning the sides and bottom of the bowl to the shape illustrated. This portion of the turning can be done with a carefully sharpened scraper tool.

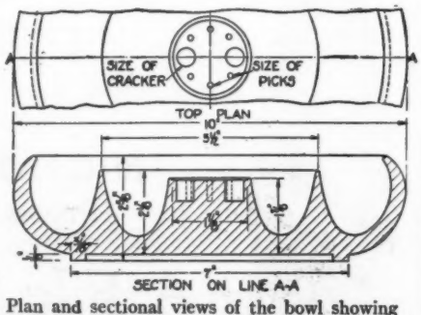


One compartment is for fresh nuts, the other for hulls.

After the sides and bottom of the bowl have been brought to the desired shape and thoroughly sanded, stain and fill with a wood filler of the desired shade. Next, apply two coats of high-grade varnish, rubbing each coat down with fine pumice stone and oil and finishing the last coat with rottenstone. All of the finishing process should be carried out while the work is still in the lathe. In this way an extremely high polish can be obtained.

Remove the bowl from the faceplate and fasten a 2-in. piece of pine of the same diameter in its place. In this piece cut a recess having a diameter equal to the outside diameter of the rim on the bottom of the bowl and a depth a little greater than the height of the bottom rim. As the recess is being cut to size, fit the rim of the bowl into it until a tight fit is obtained. Push the bowl into this chuck and turn the inside to shape, being careful not to make the sides and bottom too thin. Sandpaper the inside and finish it before removing the bowl from the wooden chuck.

The holes for the nutcracker and picks can be bored with drills of the correct size, the two large holes being drilled to fit each leg of the nutcracker. If desired a protecting ring of felt or other material can be glued to the underside of the bottom rim.—RICHARD GRAVES.



Plan and sectional views of the bowl showing the construction and necessary dimensions.

Perfect Screw Points Make Easy Boring

This little screw-threaded point is as important on a bit as a propeller on a plane! If it is clean-threaded, sharp and accurate, it will screw itself firmly into the wood and draw the bit after it. This relieves hand pressure and makes easier boring.

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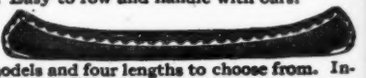

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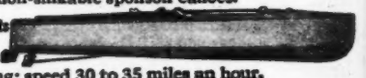

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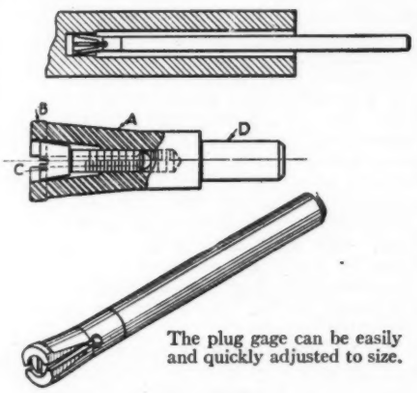
FOR the average run of work where small holes are to be gaged, the inside caliper is, of course, the proper tool to use. But not every mechanic can feel a few ten thousandths, and inside calipers often cannot be used at all where a hole of any depth is to be examined. Usually special plug gages are made up to suit the work in hand, but even with a number of such gages, it is frequently found that not one of them is right for the new job.

The adjustable small-hole gage illustrated will take care of any variation from a nominal size that is likely to occur, and will allow the hole to be checked to within two ten-thousandths or less.

The instrument consists of a slotted tool steel head *A*, having a short and slightly rounded measuring portion *B*,



The plug gage can be easily and quickly adjusted to size.

which is spread to the desired size by means of an adjusting screw *C*. A reduced shank *D* at the rear is made to receive a handle. It will be noted that the slot ends in a cross-drilled hole, and that the sides of the two jaws are flattened to prevent them from touching.

An included angle of about 10° for the taper bore and one of about 15° for the head of the spreading screw are used. The cross section of the measuring portion is rounded to correspond with a radius equal to or somewhat less than the gage size, to prevent the possibility of binding in the hole when held at an angle.

In making the head, the measuring end should be turned from .005 to .0075 in. smaller than the smallest intended gaging size. This is to insure a proper contact on opposite high points of the jaws.

For hardening, the jaws should be partly closed by several turns of small wire put around back of the measuring portions. The part around the cross-hole should be drawn to a blue temper with only the faintest color showing on the contact surfaces. The head of the spreader screw should be casehardened to a slight depth.

The gage is intended for a total size variation of about 6 or 7 percent above the solid turned diameter. In a ¼-in. tool this means that it may be made to serve the range of sizes between .242 and .258 in. The head blank in that case should therefore be turned to a diameter of about .237 in.—H. S.

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"Now I can have a Chris-Craft!"—Instantly the thought will spring into thousands of minds upon reading this announcement: A 17-foot Chris-Craft priced at $1295! A moderate down payment will now place in your hands the finest motorboat of its size in the whole world. ▾ ▾ ▾ Chris-Craft ownership, long a source of pride to those who can afford anything they want, is now within reach of the family of moderate income. ▾ ▾ ▾ Continually increasing leadership, multiplied sales, and new economies, make it possible for Chris-Craft to offer this 17-foot luxury craft at $1295. ▾ ▾ ▾ A marvelous boat it is, true Chris-Craft in every inch of its gleaming mahogany hull, Chris-Craft in its staunch seaworthiness, Chris-Craft in its speed and complete safety. Chris-Craft quality is evident in its luxurious cushions, in the automobile type steering, starting and lighting devices, horn and windshield. Its full-powered dependable motor, its sturdy double-planked bottom and its marvelous control are typical Chris-Craft characteristics. ▾ ▾ ▾ True Chris-Craft it is, full brother to the magnificent Chris-Craft Yacht itself, and equally the envy of all beholders. To thousands who have dreamed of some day owning a Chris-Craft this announcement will mean dreams come true. See your Chris-Craft merchant today. Buy early. Make certain of delivery for a full season of outdoor joy. Write for catalog describing the entire fleet of 25 Chris-Craft models.

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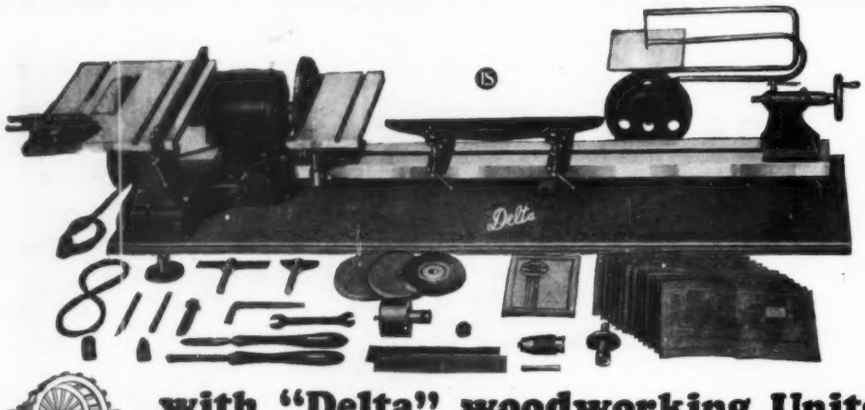

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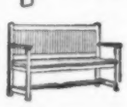

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A definite program for getting ahead financially will be found on page four of this issue

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WE FURNISH BIOLOGICAL SUPPLIES TO SCHOOLS AND COLLEGES OF THE COUNTRY

Amos 'n' Andy Explained

(Continued from page 23)

Every time we have a chance to throw off the shackles of repression, we take advantage of it.

The college yell is a strong case in point.

"Rah-rah-rah!" the students shout. "Sissboom-bah!"

Meaningless? Of course, but only in a way. By giving the yell, the boys vent their pent-up emotions. It really means: "Away with rhetoric, with logic, with grammar, with composition, with the classics! Down with repression! Down with the faculty! Down with all constituted authority! Back to 'eenie-meenie-minie-mo!'"

LATER in life, except on rare occasions such as college reunions, we can no longer escape from repression in that way. But now come Amos 'n' Andy. And, in effect, they do take us back to the happy days of "eenie-meenie-minie-mo." They say "regusted" and "propolition." Their taxicab company is "incorpolated." They call a manicure a "manana cure," and the Interstate Commerce Commission the Interstate Commerce "Remission." They tell each other not to be "disenrecouraged." When their memory fails them, they remark: "I disremember."

Puns and baby talk! No wonder children and grownups alike are extremely fond of them. For the children, "the lid is off." Improper English is not only permitted, it is funny and admirable. Father and mother are laughing tears, just as they do when they take you to the circus. And the adults are given a quick return trip to the paradise of early childhood. One may be fifty and repeat what Amos 'n' Andy say; one may even use their expressions in a business letter without being considered foolish. The comedians have furnished the excuse.

But the necessity for talking properly is by no means the only oppression under which we chafe. We all are oppressed by somebody or something. One man is oppressed by his boss; a second by his competitors; a third by his bank; a fourth by the stock ticker; a fifth by his wife; a sixth by the policeman at the corner; a seventh by Prohibition or any other law. Government oppresses some of us; religion others. Many people are oppressed by poverty; a few by riches. Thousands are oppressed by ill-health and by real or fancied hard luck. Children are oppressed by their parents, their older brothers and sisters, their teachers. Ask a child what it wants to be when it grows up and nine times out of ten the answer either will be "a policeman" or "a teacher."

ONE quick and easy means of escape from all these forms of stress is wit or humor. Laughter is the universal antidote. But some humor is more "sure-fire," as they say in the show business, than others. Aside from their garbled words and puns, Amos 'n' Andy use few if any jokes or "gags." They rely mainly for their laughs on situations. Besides, they have a peculiar ability for choosing apt and funny names for the various characters they introduce in their skits.

Their comedy is of the black-face variety. This always is "sure-fire." From time immemorial, people have made fun of those minorities among them who did not speak the language well. Cultured human beings like to display their superiority over inferior classes and races by criticizing their grammar and pronunciation. The ancient Greek and Roman writers of comedies introduced in their plays characters speaking the dialect of subject races. In European plays, to this day, comic relief often is supplied by peasants talking dialect. In this country, the comedian usually is a "Dutchman" (really a German), an Irishman, a Jew, an Italian and, particularly, a negro. McIntyre

(Continued on page 121)

Amos 'n' Andy Explained

(*Continued from page 120*)

and Heath, with "The Georgia Minstrels," in basically the same acts that Amos 'n' Andy do, were the longest enduring team in American vaudeville. They traveled up and down the country for more than half a century. Conroy and LeMaire, another black-face team, also continued successfully for a very long time. The records made by Moran and Mack were the biggest sellers in the history of the phonograph business. Al Jolson is the highest paid entertainer in musical comedy and in the talkies. Why is dialect comedy so amusing to us? Because we ourselves have got away from our childish way of talking. And why is negro dialect funnier than any other? Because, so far as the English language is concerned, it resembles most closely the talk of children.

BUT the colored people themselves are great Amos 'n' Andy fans. This is explained by the fact that all oppressed peoples derive comfort from seeing themselves presented in an amusing light. The Jews are another example of this mental attitude.

As for situation, Amos 'n' Andy use the time-honored device of the big fellow bullying the little fellow, who, however, triumphs in the end by dint of greater smartness. Andy is lazy, stupid, conceited, and domineering. Amos is industrious, modest, submissive, but comparatively clever. This, too, is "sure-fire." It is the idea underlying the Mutt and Jeff comic strip, the widest read of all newspaper cartoons. It also is the secret of the tremendous success of Charlie Chaplin on the screen. Though there is no definite bully character in the Chaplin comedies, Charlie is the pathetic, oppressed little man faced by almost overwhelming odds. But because he is smart, he nearly always manages to outwit the police or whatever other force threatens to crush him.

Just a word as to the funny names Amos 'n' Andy use for their background characters. The head man of their lodge is called "the Kingfish"; the lodge itself, "the Mystic Knights of the Sea." The colored woman running a beauty parlor is "Madam Queen." These names strike us as particularly apt and right, because negroes in reality might actually use them. But that does not make them hilarious. For the psychological reason that they impress us as so very comical we again must go back to our childhood, when we established our superiority over others by giving them nicknames.

ANOTHER "sure-fire" quality in the Amos 'n' Andy comedy is that their humor is grim. Carefully analyzed, there really is nothing jolly about their material. The characters are in constant difficulty; their financial and love affairs are always in a muddle. But they make the best of a bad bargain. This is known as "the humor of the gallows." It, too, is borrowed from the comic strips, the Chaplin and other screen comedies, and many earlier sources. It is the kind of humor that makes the spectator or listener feel: "Well, if those fellows with all their troubles can laugh at their hard luck, I am, after all, not so badly off myself."

The secret of the Amos 'n' Andy success then, is that, either by accident or design, knowingly or instinctively, they have taken several "sure-fire" comedy devices and welded them into a whole—garbled words and puns, black-face dialect, the big-fellow-and-little-fellow situation, funny nicknames, and the humor of the gallows. And they present this mixture in a manner so childish and simple that it can be followed and understood by anyone without the slightest effort.

But even this, though it explains their universal appeal, does not account for their overwhelming (*Continued on page 122*)

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Amos 'n' Andy Explained

(Continued from page 121)

popularity. This, of course, is where the radio comes in. One does not have to go to a theater to hear them. All one has to do is to be home at the time they broadcast, turn a dial, and "here they are." It does not cost anything. In the words of my friend: "You sit in your chair for fifteen minutes, forget everything, and just laugh." The obvious result is that they are known to, and liked by millions, instead of thousands as might be the case were they popular stage entertainers. If the radio had been invented when Weber and Fields were at the height of their powers, they, too, might have had millions of admirers.

WHO are the workers of this modern miracle and how do they go about their business of amusing virtually an entire nation?

Gosden, the Amos of the pair, was born in Richmond, Va. Thus, the Southern dialect comes naturally to him. He is thirty-one years old, married, and has a twenty-months-old son. Correll, Andy, is a Northerner, a native of Peoria, Ill. He is forty and married.

The men met in Durham, N. C., in 1919, when both were employed by a Chicago concern that staged plays for amateur dramatic organizations.

They broadcast for the first time in the spring of 1925, from station WEBH, Chicago. On January 12, 1926, they went on the air for the first time as "Sam 'n' Henry," black-face comedians.

Two years later, at the close of their 568th broadcast as Sam 'n' Henry, they created Amos 'n' Andy for station WMAQ, of the Chicago *Daily News*. In August, 1929, they began broadcasting over the National Broadcasting Company's network, sponsored by a toothpaste company.

All of the Amos 'n' Andy material is written by Correll and Gosden themselves, usually between nine A.M. and noon. Correll (Andy) operates the typewriter, while Gosden walks up and down, usually jingling a handful of coins, a peculiarity of his. Both contribute ideas. Like composers of music, they mark their manuscript with the "mood" in which the dialogue is written, such as "sad," "gay," "lazy," "peppy." This is done so that "Bill" Hay, their announcer, can cast his announcement in the same tempo and mood as the rest of the broadcast.

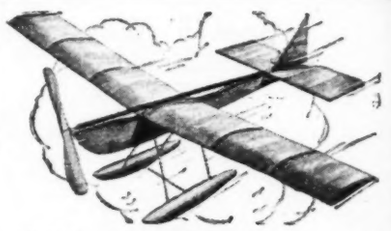
THEY take their work very seriously, and, according to eyewitnesses, "live" their characters before the microphone. Correll projects Andy's booming bass voice by speaking close to the microphone. Gosden produces his falsetto about a foot and a half away from the "mike."

The National Broadcasting Company pays Correll and Gosden a salary of $100,000 a year for their Amos 'n' Andy broadcasts. A revealing sidelight on the characters of the two men is furnished by the fact that they split this princely sum in three parts, paying one third to "Bill" Hay, their announcer, for no other reason than that "he has been with us from the start."

As this is written, they are negotiating with a motion picture company for the making of a talkie. It is said they will receive $250,000 for fifteen weeks' work.

Exorbitant? Not a bit of it. Anyone who has the ability to make millions happy is worth all he can get.

If you enjoyed the Jordanoff articles, watch for next month's issue. Another noted airman tells of his exciting career in aviation. You will be thrilled by his narrow escapes from death! Order your copy in advance.



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28x5.25	18"	2.95	1.35	32x4½	3.20	1.45
30x5.25	20"	2.95	1.35	33x4½	3.20	1.46
31x5.25	21"	3.20	1.35	34x4½	3.45	1.46
30x5.77	20"	3.20	1.40	30x5	3.60	1.75
32x6.00	20"	3.20	1.40	33x5	3.60	1.75
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How They Trailed a New Planet

(Continued from page 28)

"discovered" the planet, on paper, and predicted exactly where to look for it in the heavens.

How Dr. Lowell could locate so definitely a planet he had never seen is made easier to understand by the parallel case of Neptune's discovery nearly a century ago. This was the second planet really to be "discovered" by astronomers. The first, Uranus, was a lucky find of Sir John Herschel's, when in 1781 he swept the British skies with a homemade seven-inch reflecting telescope. But Neptune's finding was a star-gazing feat backed by mathematics.

URANUS, once found, had failed to follow the eighty-four-year course around the sun that astronomers predicted for it. As if pulled by some invisible hand, it sped ahead of its expected itinerary until 1822; then it began to lag behind. The "invisible hand" was thought to be the pull, by gravity or tidal force, of some unknown planet beyond Uranus. "We see it," Sir John Herschel remarked, "as Columbus saw America from the shores of Spain. Its movements have been felt trembling along the far-reaching line of our analysis with a certainty hardly inferior to that of ocular demonstration."

It may have been that sincere, if high-sounding, declaration that spurred two men, unknown to each other, to tackle the formidable mathematics necessary to locate the unseen planet — John Couch Adams, in England, and U. J. J. LeVerrier, in France. Adams finished first, but British astronomers who sought the planet at the spot he indicated were too slow. In the meantime, one day in September, 1846, the Frenchman had sent this rather cocky message to Johann Gottfried Galle, an astronomer of the Berlin Observatory:

"Direct your telescope to a point on the ecliptic (the single plane in which all planets revolve about the sun) in the constellation of Aquarius, in longitude 326°, and you will find within a degree of that place a new planet, looking like a star of about the ninth magnitude, and having a perceptible disk."

On the night of September 23rd, Galle looked. In half an hour he had found Neptune. LeVerrier was not thrilled. He knew that he simply could not be wrong. He never bothered once during his lifetime to look at his planet through a telescope. But the world hailed the addition of a new planet to the solar system.

NOW Dr. Lowell stepped into the picture. He was one of the first to point out that the new planet Neptune did not, as astronomers had hoped, explain all of Uranus' outlaw conduct. It helped, but minor irregularities still remained. As early as 1902, Dr. Lowell declared he believed that still another planet, beyond Neptune, was responsible for these. In 1915 he published his figures which definitely located, in one of two possible positions at opposite corners of the sky, the unknown planet that was causing Uranus' trouble. Undoubtedly it was troubling Neptune, which was nearer to it, even more. Little information on this point was available, though, since Neptune had completed only a fraction of its circuit around the sun since its discovery. That had forced Lowell to base all his figures on distant Uranus, making his feat all the more remarkable.

The figures were completed just in time, for Lowell died in 1916, the plane still unfound. But he had left an observatory and the best of clues. The search continued, encouraged by the belief of others in a new planet, notably Prof. W. H. Pickering, observer in Jamaica (P. S. M., Aug. '28, p. 60). *(Continued on page 124)*

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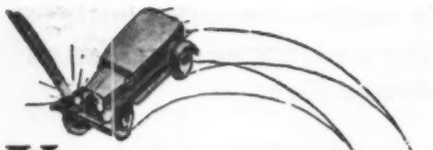

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How They Trailed a New Planet

(*Continued from page 123*)

Last year came another big aid—the most powerful photographic telescope of its kind in the world, which looks more like a huge camera than a conventional telescope. Its thirteen-inch lenses were ground to an accuracy of better than one millionth of an inch.

It remained for a former farm boy to finish what Dr. Lowell had started. When this nineteen-year-old lad, with a hobby for astronomy, Clyde Tombaugh, graduated from high school at Burdette, Kansas, five years ago, his sister read a class prophecy naming him as the future discoverer of a new world. That prophecy was to come true.

Tombaugh, having successfully applied for a job at the Flagstaff observatory, sat one day last January in front of a "blink microscope," examining fourteen-by-seventeen-inch photographic plates he had just taken of the heavens. The instrument he was using is one of the most modern aids to astronomers. Put in it two plates taken at different times of the same sky region, adjust them until they match perfectly, look in an eyepiece, and operate a lever. A flopping shutter hides first one plate and then the other. Stars, which are fixed in the sky, appear to stand still. But any object that moves or flickers, such as a comet or a planet, stands out like a beacon in contrast to the rest.

THUS Tombaugh had already examined, perhaps, a thousand slides. But now his practiced eye caught a flicker of something new. He stared into the eyepiece. It couldn't be, but it was, the new planet.

"Excited? I should say so!" Tombaugh says. "What did the others say when I called them in to see it? Well, you know how these astronomers are. They are used to thinking in terms of millions of years, and millions of miles. They weren't excited. They said it might possibly be the Lowell planet, but they would have to watch it further to check it with data they had been gathering."

Seven weeks later Dr. V. M. Slipher, the observatory's director, telegraphed to Harvard College Observatory, official center for astronomical news, the epochal announcement:

"Systematic search begun years ago, supplementing Lowell's investigation for a trans-Neptunian planet, has revealed an object which, for seven weeks, has in rate of motion and path consistently conformed to a trans-Neptunian body at the approximate distance he assigned. Fifteenth magnitude; position March 12th, at three hours Greenwich Civil Time, was seven seconds of time west from Delta Geminorum, agreeing with Lowell's predicted longitude."

NOTE, if you please, the commendable reservation of the Lowell telegram. The astronomers did not claim to have discovered *the trans-Neptunian planet.* They simply stated that the object they had watched for seven anxious weeks had moved as a trans-Neptunian planet should. It might still be a comet, as some British astronomers suggested. The Flagstaff astronomers explained that they had made their announcement "only" seven weeks after sighting the planet simply to give other astronomers a better chance to look at it since it soon would be too low in the evening sky for further observation this year.

As the news flashed from the Harvard center, the great telescopes of the world's observatories swung on their massive trunnions to converge at the point in the sky where the new planet had been discovered — in the star group or constellation known as Gemini. It was no light matter to disrupt the twenty and thirty-year schedules of star study that many observatories are following, even to sight a new planet; but this time,

(*Continued on page 125*)

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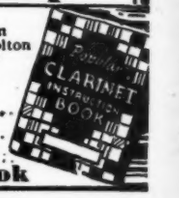

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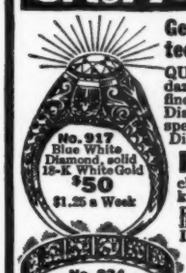

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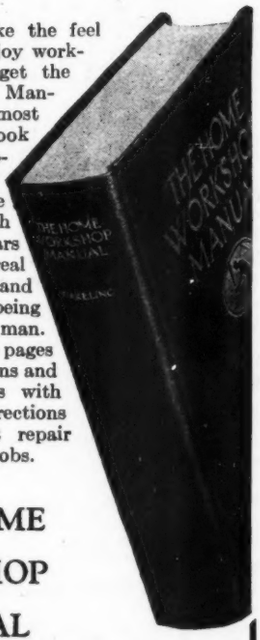

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How They Trailed a New Planet

(Continued from page 124)

studies of stars, for the moment, were set aside.

First the twenty-four-inch reflector of the Yerkes Observatory, at Williams Bay, Wis., picked up and photographed the newly-found member of the solar system. Hardly were the plates developed when Harvard Observatory flashed the news that it had snapped the planet's likeness through its sixteen-inch refractor, by a ninety-minute exposure.

"AS A small but devoted homage to American astronomy," Prof. Emilio Bianchi, director of the Brera Observatory at Milan, Italy, interrupted the important work of its Merate substation to order its powerful Zeiss telescope trained on the new planet. It secured at once two excellent photographs.

Astronomers are clever fellows at learning things about a world visible only as a small speck on a photograph. One rather startling thing they have found out about the new planet is that it seems to resemble the earth more than its nearer neighbors; its faintness suggests that it is solid rather than gaseous or liquid.

No life as we know it could exist on this frigid planet, far removed from the sun's heat. Even on its sunny side, unless it has internal heat such as the earth manifests through volcanoes, its temperature must be 382° F. below zero. If our earth were transported there, its air would liquefy and fall to the ground, where it would freeze. Only hydrogen and helium gases would remain gaseous, and thus would be left for an atmosphere, in such cold as that of the new planet.

If any creature, of some sort utterly unknown on earth, were able to stand the cold, it would not live in total darkness, but in a sort of pearly dusk, midway between day and night. The sun, 4,000,000,000 miles away, would be hardly more than a pin point of light. Yet its glow would still be more than 200 times brighter than the earth's full moon.

The new planet may have moons of its own. But unless the new planet's moons, if any, are big ones, no telescope yet built could see them.

EVEN in the short time that the planet has been known it has made notable contributions to the science of astronomy. At the outset, it is the first of the nine planets ever to be discovered by photography. The new planet's discovery practically doubles the known area of the solar system, or planet-family's, back yard. Its extreme distance from the sun, some astronomers say, kills the old idea that the planets were born by condensation from rings of gas, as raindrops condense from a cloud. No ring could exist of such size as would be required by the new planet, they say, and therefore this old "nebular" theory seems doomed.

Another remaining duty, as this issue goes to press, is to give the planet a name. Curiously, astronomers have already used up many of the most appropriate names in christening the hundreds of asteroids — those tiny bodies, believed to be fragments of a single planet, that revolve between Mars and Jupiter.

This seems to rule out one name, Minerva, suggested for the planet but already given an asteroid. One suggestion was to name the new planet after its prophet, Dr. Lowell. But astronomers believe, from past experience, that only the names of mythological deities, such as those that other planets bear, will stick. Some suggestions so far recorded are Atlas, Prometheus, and Pluto. Other names are pouring in on the astronomers at the Flagstaff observatory, who probably will be entitled to select a name for their planet.

The name may be chosen by the time you read this, thus officially welcoming the newest comer into our family of planets. Who can say whether the future will bring more?

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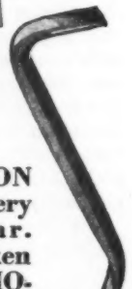

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Rot Hits American Skyscrapers

(Continued from page 60)

and settle, with dust, into the pores of the stone. A colony of bacteria transforms some of the animal and vegetable matter in the dust into nitric acid. And this, together with the sulphuric and hydrochloric acids already generated by smoke and salt in the air, happens to form the trio of the most powerful acids known to chemistry. That helps to explain what happened to the building fragments and the statues of the Cloisters after they had been in New York for some years. They began to dissolve.

Stone's third enemy is frost, which attacks any building north of the "frost line." In other words, it hits buildings in regions subject to alternate freezing and thawing. Rain water soaks into the pores of the stone and freezes. Since the ice takes up more space than water, a thousand microscopic wedges split the stone. "When I was a boy," said Professor Fink, "brown limestone, popularly known as 'brownstone,' was the fashionable building material in New York City. Look at the 'brownstone fronts' today and you will see what frost does to stone. There are gaping holes where great chunks of the stone have split and cracked off."

THE fourth enemy of stone, fully as destructive as frost, is so little known that its danger is seldom realized. It is the formation of crystals, just ordinary crystals such as you may see in a sugar bowl or salt shaker. They are made of lime salts, a material that rain water, with the aid of what little acid it may contain, dissolves in soaking through the stone. When the rain dries, the lime salts it has dissolved begin to crystallize. Those tiny crystals expand in the pores just as does frost, and split the stone. They accomplish in summer the destructive work that frost does in winter. Some of these white crystals usually may be seen under window ledges, and about three feet from the top of parapet walls.

The destructive power of crystals is illustrated by what happened to a one-piece stone fountain in the swimming pool of a great German ocean liner. Salt water gushed from it into the pool while the liner was at sea; in port, the fountain was shut off. In a few years it began to crack, and a stone expert who examined it filled a paper bag with pieces he could break off in his hands. He explained the mystery of why a fountain, not exposed to rain and weather, should go to pieces. When the water-soaked fountain was shut off in port, salt water dried in the pores. The salt formed crystals. And that was the end of the stone.

What are the remedies? The problem, of course, is almost as old as the proverbial hills. Only recently it was discovered that the ancients, who used limestone for their sculpture because they had no steel chisels able to cut granite, knew enough to rub beeswax into the pores of the stone to preserve it.

IN MODERN times, dozens of expedients have been tried with more or less success. In England, a treatment of water glass or silicate of soda was developed by government experts to stop the crumbling of the Parliament Buildings. However, this film, it was found, cracks eventually and permits the corroding forces to renew their attack. Lacquers have been tried, but were found to scale off. On the other hand, oils, asphalt, and certain chemical preparations have proved successful, but they have the disadvantage of discoloring the stone. One soaplike preparation has the fault that it is decomposed by the ultra-violet rays of the sun.

One of the most successful processes so far developed is a sort of "paraffin pack," a treatment with molten paraffin. Probably the largest rot-proofing job ever done by this method is now under way in Brooklyn, N. Y., where the New York State Arsenal, a pebbled-wall structure 350 feet long and six stories high is receiving a complete ex- *(Continued on page 127)*

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Rot Hits American Skyscrapers

(*Continued from page 126*)

terior coating from the first floor up. So far, three tons of paraffin, in bags of white slabs, have been used, and more may be required to cover the 2,000 square yards of the building's surface.

The first step in this method, as practiced by the New York concern that employs it, is to preheat a small section of the wall with a charcoal stove. Then molten paraffin is applied from a bucket with a brush much like an ordinary paint brush. It sinks into the pores of the hot rock to a depth of from a quarter to half an inch and solidifies there. The result is an impenetrable waterproof coating that will last for years and even decades, as buildings show that have been given the treatment years ago.

Charcoal burners are chosen for heating the wall because of their mild, even heat. A torch in unskilled hands would damage the wall. Experts with kerosene blowtorches, however, carefully preheat corners and angles that the charcoal burner cannot reach. After the paraffin has been applied, it is heated once more and rubbed with waste to remove objectionable gloss.

SO MUCH for the older stone-rot remedies. The new process Professor Fink has devised to save the treasures of the Cloisters from destruction will employ a mixture of paraffin and the oldest of all the stone "medicines," beeswax. First the statues and building fragments will be cleaned thoroughly, and a solution sprayed upon them with huge atomizers will remove or kill colonies of germs. Then an alkaline wash of lime water will neutralize any acids upon them and make them temporarily immune from this kind of attack. Finally, a coat of paraffin, or candle grease, mixed with beeswax and dissolved in a solvent to make a clear liquid, will be sprayed upon them with force pumps. When the solvent evaporates, every pore will be plugged up with wax against rain, acid, and germs.

Stone rot creeps in to begin its work of disintegration by way of the pores. The more porous the stone, the faster it rots away. Granite is particularly resistant. So is hard brick, although the mortar may sometimes be a weak spot.

But even the softest stone would last almost forever if a suggestion by Professor Fink could be worked out in actual practice.

His idea is to armor-plate the building with a sheath of stainless steel. Perhaps the future industrial center will be a city of silvery towers gleaming in the sunlight, each one encased in a shell of steel. It is a strangely beautiful picture, and not at all a fanciful idea, according to Professor Fink. It may, in the end, prove the only lasting way to protect structures against the ravages of rot.

Since the introduction of the first stainless steels, Professor Fink says, others of even greater corrosion-resisting power—alloys of iron, chromium, and nickel—have been developed that really deserve the title of "super stainless steels." Under various trade names these have been used for some parts of building exteriors, such as the sheathing of pillars. There is no good reason, Professor Fink suggests, why some day they should not be used to cover whole buildings. The stone or reënforced concrete which could be used within the sheathing would not need to be expensively finished, since only the metal would be seen. And the metal would resist corrosion indefinitely. Perhaps, after all, stainless steel will be the architect's answer to the rotting of stone.

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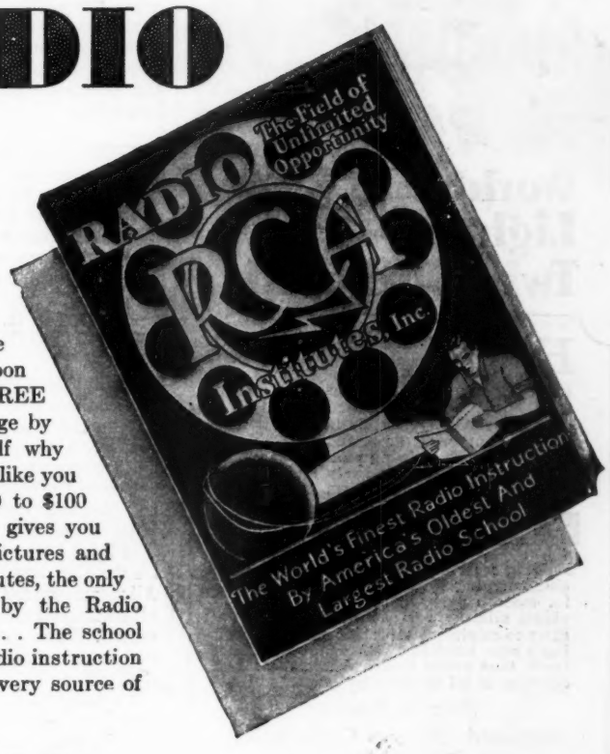

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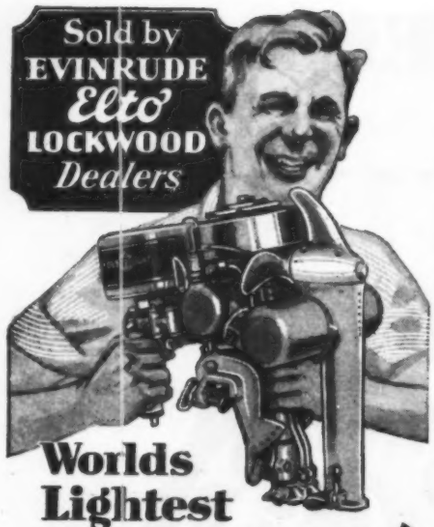

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Midnight—The Mail Flies West

(*Continued from page 25*)

When I climbed down from "29," Maxwell led me through a door in the side of the hangar into the field office of the air mail line. Across one end of the room stretched a large map with a wavering line of pins with red, blue, and yellow heads. They mark the route to Cleveland—the red pins indicate emergency landing fields, the yellow ones point where weather reports are made and the blue ones where ordinary beacons are located. Weather reports come in at fifty-mile distances, and at night the beacons flash signals at six- to ten-mile intervals.

UNDER the map was a row of automatic typewriters, run by telegraph. The messages coming in over the wires are typed on strips of paper like stock ticker tape. One of these teletypes is connected with the Newark telegraph office to send out and receive ordinary telegraph messages. It was chattering away, sending in this telegram from Cleveland: "SAD DAMSEL WILLIAMS SHOCK THEATRICO MIDRASH MACALON PENITENCE."

"What does that mean?" I asked.

"That's a code message," Maxwell told me. "It means that pilot Williams left today at 12:20 P.M. on plane 77 with fifteen pouches and two pieces of mail totaling 450 pounds."

One of the other teletypes is connected with the Newark post office, the Newark weather bureau, and the Hadley Field radio station. The third hooks up Cleveland, Bellefonte, and all weather reporting stations along the line. All messages that go out appear on the tapes of all connected teletypes and form a permanent record. When a message is meant especially for one station, a bell rings. Each station has a distinctive ring, as in a party-line telephone.

"Brownie left Cleveland at 9:30," called a man bending over the tape.

"Brownie" is Henry J. Brown, famous fog-flyer of the air mail. He holds the record of two hours and ten minutes between Cleveland and Hadley Field. The average is three hours and a half. The record for the slowest flight is held by Dean Smith, now with the Byrd expedition. He took six and a half hours for the trip. It was a clear, beautiful night and he "went visiting" along the way, flying over Pittsburgh and Toledo on a roundabout course!

IT IS nearing eleven o'clock. In the Government weather station back of the field house, Trolle, night weather man, is filling a three-foot rubber balloon with hydrogen. Every six hours a red balloon is sent up—at night bearing a candle-lit lantern—to discover the direction and force of upper winds. Its course is followed through instruments for twenty-two minutes, the gas lifting the rubber ball at between 500 and 600 feet a minute. Tonight, Old Man Jinx is riding the little balloons. The first one rises rapidly, veers to the right, and continues its upward course directly behind a tall chimney so measurements can't be taken. The second balloon bursts; the third breaks loose in the gusty air and sails off before the instruments are ready. Four times Trolle tries before he gets his record.

When we return to the weather station, the two pilots who will hop off with the midnight mail, Samuel "Sammy" Samson and E. E. "Dutch" Underhill, are studying the chart labeled "Airway Weather Report" which covers most of one wall. Underhill is a cricket of a man—small, alert, active, his close-cut pompadour sticking straight up. He was a "gypsy flyer," barnstorming about the country in his own plane, before he joined the air mail. When the Mississippi flood occurred, he was in the south and flew in rescue work for the Red Cross. He has flown far in excess of a quarter of a million miles.

Samson, a product of the Army Air Corps, is tall, powerfully built. He suggests a rangy, hard-hitting fullback. This physique probably saved his life a few months ago when he joined the Caterpillar Club near Chicago. It was thick weather. He couldn't find a hole in the fog to get down. The ship was running out of gas. He climbed over the side of the cockpit to jump. One foot caught between the fuselage and the exhaust pipe and jammed. He wiggled and twisted. It wouldn't come loose. Reaching down, he grabbed the steel pipe with both hands and yanked. When the crashed plane was discovered, the exhaust pipe was found bent into a V.

"BOY! A clear night, unlimited visibility, and a tail wind. Whoopee!" shouts Underhill. It might be explained that the prevailing wind is from the west. Usually, pilots flying to Cleveland battle head winds. When they get a tail wind they make the most of it.

In the pilot's room, behind the weather station, "Dutch" and "Sammy" climb into their flying togs. The room contains two cots. At their heads are canopies of mosquito netting that can be adjusted in summer as a protection against the insects. Along the wall, a row of nails hold the parachutes hanging in their heavy harnesses. On Samson's is drawn in ink a crude silkworm with the word "caterpillar" on it. He is one of the three flyers on the eastern division who have saved their lives recently by trusting to parachute silk.

To each 'chute is snapped a flashlight and a revolver in its holster. When these pony express riders of the sky take off they are always armed. Even when they leap into space with their parachutes, their revolvers go with them. Valuable securities often go by air mail. They must be guarded in a forced landing. When one plane crashed, a few weeks ago, $2,000,000 worth of securities are said to have lain in it for two days before it was found.

Underhill goes to a white box nailed to the wall. On it is printed in red letters: "COTTON FOR EARS." He stuffs both ears full as a protection from the cold and the roar of the engine. Then he slips on heavy woolen socks, sweaters, and finally a bulky leather flying suit and heavy fleece-lined moccasins.

"You ought to see 'Brownie' come in," Maxwell remarks. "He wears half a dozen sweaters and overalls under his flying suit. It takes him half the night to get his clothes off."

UNDERHILL shouts in Samson's ear: "I sure will be thinking of you tonight, Sammy, up in that cold '27.' It will be hard to keep my mind on my piloting, worrying about your little feet being cold." Then he ducks. Samson has drawn the Douglas No. 27, for some unknown reason the coldest ship of the fleet. "Yes, and you probably will spin that Boeing of yours in somewhere along the line," jeers Sammy.

But a few minutes later, when they come out to the waiting ships, there is no jesting. Their jaws are set. It is no joke to hop off over jagged mountains in the inky darkness trusting to the even beating of a steel heart fed by gasoline. It is a cold-blooded gamble with death.

Underhill's Boeing is ready. The pouches of mail are packed firmly in the compartment between the motor and the cockpit. The big Hornet engine is warmed up, ready for the gun. Awkward in the bulky flying clothes, with the seat parachute banging the back of his legs, the pilot waddles Eskimolike from the hangar and climbs into the cockpit. A silk scarf is tied across the lower part of his face. He adjusts a leather face mask. Only his eyes peep through. He pulls down the goggles and carefully adjusts the radio headphones. The goggles steam up from the heat of his body. (*Continued on page 129*)

Midnight—The Mail Flies West

(Continued from page 128)

He wipes them off, then opens the throttle and watches the instruments while the engine howls and the Boeing tugs at the restraining chain. The engine is O.K. He throttles it down, gives a last look at the red and white striped wind cone streaming straight into the west above the hangar, and signals to unhook the chain.

HIS lights snap on, the signal to illuminate the field for the take-off. The floodlights flare. A carpet of bluish light seems to spread a coating of frost over the rolling field. Underhill gives the Boeing the gun. Sparks fly as the steel tail skid bumps over the concrete runway. The plane gathers speed, sends back a cloud of red dust. When this clears, the ship is in the air. Its riding lights, red on the left, green on the right, white on the tail, wink in the darkness as the plane swings into a climbing turn and heads west. A moment later they disappear as the ship whines off into the night.

A few minutes later, Sammy hops off and the mechanics make a rush for the hangar to get out of the biting wind. The field office teletypes are chattering. "Brownie" has left Bellefonte and Eskew, bringing the second section from Cleveland, is close behind. In the last six months, Maxwell explains, two sections of night mail in each direction have become necessary. The volume of air mail has doubled. The outgoing mail at Hadley Field averages 2,000 pounds on week nights. Every twenty-four hours, approximately 8,000 pounds of mail pass through the little field post office where four armed men work at high speed over steel sorting tables.

The floodlights suddenly illuminate the field. "Brownie" is coming. The operator has seen him flash on his wing landing lights. Sometimes, on clear nights, these lights can be seen when the plane is still twelve miles away. South of the hangar, two round, yellow, owl-like eyes loom out of the darkness. They are the wing landing lights of the invisible plane. Between them is a glowing, cherry-red streak—an exhaust pipe red-hot from the battle with the wind. With a whistling rustle, like the passing of a huge bird, the ship sails over us. Suddenly it appears, all silver, settling down on the frost-colored field. It has dropped into the brilliance spread by the floodlights. It rolls to a stop, turns, and with racing motor taxis up to the hangar. "Brownie," stiff with cold, stumbles down and enters the field house to make out his pilot's report.

BEFORE he has finished, the floodlights flare again and Eskew lands. He says he met Sammy right above Greenwood Lodge, the highest beacon on the route. "He had his nose down, flying like a bat, clipping the trees," he tells us.

Underhill and Samson are leaving the mountains by now, if all is well. They are speeding high above the sleeping farms of Ohio, well on their way to Cleveland. "Brownie," who spends his off moments reading Mark Twain, finishes his report and begins peeling off his many sweaters preparing to turn in on one of the cots in the pilot's room. Mechanics check over the planes that have just come in. Later, the "puddle-jumper" hops off for Newark and the ships of the Pitcairn line start for Washington, D. C., and Atlanta, Georgia. But the main excitement of the night is over.

The men at leisure stand about the teletype, waiting for word from Cleveland. Their attitude conveys a certain tenseness. For Death still rides the air lanes and the men who "push the mail" follow a dangerous calling. Finally, a little after three in the morning, the typewriter clatters its message. Underhill and Samson have landed. These daring riders of the night sky are safe. Again, the air mail has gone through.

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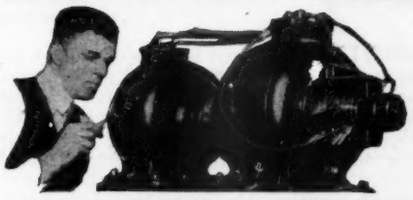

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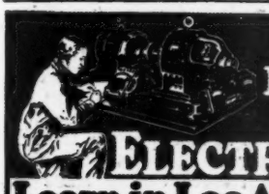

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How I Made My Glider Records

(Continued from page 41)

which I believe had not been used before, I got up into the higher air. There I made a turn around Point Loma, gaining more altitude, and keeping what I gained by that same sideways slip with the leeward wing down. I rose, in a few minutes, to nearly 1,500 feet. There I stayed until dawn broke over the eastern mountain wall—the most welcome day I ever have seen. I have since found that I can perform this altitude-gaining trick with any sailplane, and I used it again and again on my second flight.

DAWN found me still close to 1,500 feet in the air, but very tired from a full day of work and a night of flying, most of the latter spent in the hard and nerve-trying effort to maintain altitude. The sun showed me the white sea pounding on the rocks, the tireless observers and officials still watching me from places of slight vantage in the rain which covered Point Loma like a blanket. Shortly after daybreak, there came a material lull in the wind, while the volume of rain fell off. I lost a little altitude, but, by the new trick of operation, regained it, sailed about awhile, and then came down, in a smooth and easy landing, on the road that runs parallel to Point Loma and only a short distance from the starting point. Official watches showed that I had been in the air six hours, nineteen minutes, and three seconds, then the longest flight ever made in America in a glider of any type.

One of the several remarkable features of this flight is that it demonstrates clearly the ability of a sailplane to remain aloft in wind, rain, and darkness, and that none of these elements are to be feared by the trained glider pilot. Air currents of almost any character, direction, and speed can be made to carry the sailplane, if the pilot is well trained. The flight proved, too, that it is possible to land a large glider on its keel, without wheels, with no damage to machine or pilot, in brush and on uneven ground—a matter of great difficulty and no little danger with a power-driven plane. I myself was astonished at the ease with which I piloted the sailplane back virtually to the point of take-off. For much of the time during the later hours of this flight, the air was "bumpy" and the currents uncertain, so that it was necessary for me to "feel" my way through the darkness and to find and take advantage of the varying air currents into which my sailplane drifted.

This must be much the manner in which a large bird finds its way through darkness, rain, and inimical air movements. Thus, glider flying approaches as nearly to the flight of a bird as man is likely to attain unless and until he sprouts wings.

ON MY second flight of a little more than nine hours, I made the easiest and quickest take-off I ever saw. From a spot on Point Loma near the starting point of the previous flight, the men on the shock cord ran only about fifteen feet before the sailplane took the air, caught the current, and began to rise. I sailed about 100 feet in a practically horizontal position, and then climbed easily on an updraft to nearly 1,500 feet above the take-off. This was in the same sailplane used on the flight above described, and the total weight was approximately the same—333 pounds.

The start was made at 5:37:03 P.M., and the wind, blowing steadily from the west, remained at about thirty-five miles an hour for nine hours of the flight. This was a stiffer wind than before, and I had no trouble in maintaining altitude and in cruising back and forth over the point and up and down the coast. There was no rain and few "bumps" in the air, but about two A.M., the wind shifted to the northwest, then to the north, and decreased in power, falling to almost nothing, so that I was compelled to come down. The wind had been cold, and, unprotected as I was in the open cockpit, I was thoroughly chilled and quite willing to land, which I did, within about 100 feet of the point of take-off. In spite of the darkness, the sailplane made a perfect landing in the center of a hillside road.

Had the wind maintained its velocity, or dropped to no less than eight or ten miles an hour, I could have remained aloft indefinitely. If I could have stayed up fifty-five minutes more, I should have won the E. S. Evans prize for remaining aloft ten hours. Next time I may be able to do it. If favoring air currents can be found, there seems ample opportunity, especially in this section of the United States, to break the fourteen-hour durance record made in Germany. The widespread interest in glider flying was well shown by the fact that more than fifty persons made the trip to Point Loma, in the stormy night, to see the first flight, while more than 300 came to see the start and remained to view the late afternoon flying on the nine-hour attempt to shatter the world's record.

MY EXPERIENCE in glider and sailplane building and flying covers nearly twenty years. I built the first model in 1910, at Los Angeles. Then I built other models, including both land and seaplanes, all of which flew; but they were too small to carry passengers. Among my other successful models was one which was propelled by the explosion of a ten-cent skyrocket, on the same principle as the "rocket car" and "rocket boat" built recently in Germany.

Spurred on by the flights of these models, I built my first "man-size" glider in 1911. It was a monoplane, fearfully and wonderfully made as compared with the Bowlus sailplane of today. It had wings, fore and aft, hinged to the "body," as we then called the fuselage, and the flyer was strapped in. The landing gear consisted of two rockers from an old rocking-chair. The glider was built of redwood, except the ribs, which were spruce. The tail was built like a bird's tail, or rather like a fan, which could be spread out or retracted at the will of the pilot.

In this now primitive powerless plane, I actually flew 200 feet, and cracked up only because I did not know how to handle the controls. To launch this glider, I strapped myself in, stood up, ran downhill, and, when the air lifted me, tried to control it with wings and tail and thus gain altitude. Being only fourteen years old, and without previous training in flying, my "flight" of 200 feet was much more than a "nine days' wonder."

AFTER the crash, I rebuilt this glider by dashing home from school at noon, doing without lunch, and working until one o'clock. When I had completed it and had it anchored with rocks, a whirlwind picked it up one afternoon while I was at school, carried it about 300 yards, and demolished it. My next effort was more ambitious. I felt that I needed more surface on the wings, so I built a biplane, with full controls. It had a wing spread of thirty-five feet with chord of four feet, and was large enough to carry a motor. The wings were not tapered, as at that time we had not heard of tapered wings. There were twelve struts, and the turnbuckles were made by myself from the wire spokes of bicycle wheels. For landing gear, I attached three bicycle wheels. The pilot's position was lying down, with a real steering wheel in front of him with which he controlled rudder and wings. His feet were in stirrups, by which he operated the tail and could also handle the rudder. It was a far more complicated machine than the Bowlus sailplane of today, but no one *(Continued on page 131)*

How I Made My Glider Records

(*Continued from page 130*)

could have remained aloft nine hours in it.

I was invited to bring my glider to the annual track meet of the San Fernando High School—the local Olympic Games. There I went, with goggles, an arm band telling the world that I was an "aviator," and a multi-colored stocking-cap. On the first "flight" I could not get off the ground because of the short tow, due to lack of length of field. On the second trial, I gained an "altitude" of eight feet, and remained in the air for 800 feet, but the landing gear broke and I was thrown out when I came down.

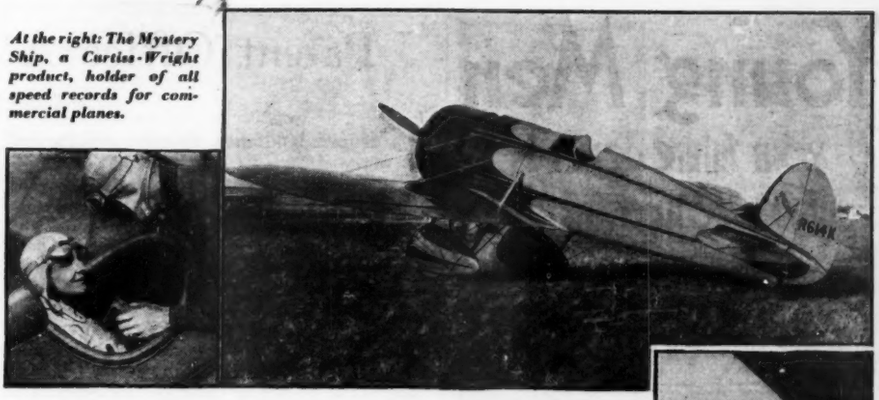
When my brother and I tried this glider again, we tied it to a stake on the windy San Fernando hills, preparatory to "taking off." My brother got into the glider and I went back to the wagon for a piece of equipment. When I returned, the wind had picked up the glider like a kite, and there was my brother, "sitting pretty," or rather lying so, with his anchored glider some fifty feet off the ground, but unable to go backward or forward owing to the tie rope. I released the rope, and he flew several hundred feet to a more or less successful landing.

PRIOR to designing the present sailplane, in which I made the American altitude and duration records, I built fifteen different gliders. Since then I have designed and built six others, including the newest "Anne Lindbergh" sailplane, flown recently by Col. Charles A. Lindbergh. As demonstrating the value of glider training, I may say that, in 1917, I soloed in a power plane *with thirty-five minutes instruction*. Glider training gives the prospective aviator the "feel" of the air, balance, knowledge of controls, and quick thinking, while it also takes from him whatever fear he may have when he first takes off. Not only do gliders furnish opportunity to students to learn *actual* flying, but they can teach us all we want to know about air currents, how to maintain altitude and motion without power, and also open a virtually unlimited field for the development of new ideas in construction and method of flight, both powerless and powered—all at very low cost.

Undoubtedly, glider flying stimulates interest in aviation. The sailplane is the airplane of the boy or girl who wishes to "get into the air." Nothing will develop an interest in aviation in our youth so rapidly and so soundly as glider building and flying. As a sport, gliding provides all the thrills of actual bird flight and is in addition educational and constructive.

Germany today has almost as many glider clubs as there are golf clubs in the United States. Gliders and sailplanes, in the hands of youths as well as older men, are being flown all over Germany, with the result that the German people are more airminded than any other nation, not even excepting the Americans. Yet some idea of the spread of the "glider idea" may be gained from the fact that of eleven pilots who have obtained first-class glider licenses in the United States, ten were trained by the writer of this article. Within a short time, so large are the classes of boys and girls, the issuing of licenses at San Diego alone will reach five or more a week. This, it should be remembered, is in a limited area of one section of the United States, virtually all of whose territory is suitable for sailplane flying.

Next month: The clearest and most complete popular explanation ever presented of the principles of gliding. How does a glider operate? How is it controlled? How does it stay aloft? Where does the glider's "power" come from? These and many other questions uppermost in the minds of motorless-flight enthusiasts will be answered in this absorbing and authoritative article.



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Patent Office A National Disgrace

(Continued from page 21)

be a definite hindrance, delaying still further the work.

To understand this, we must look at the manner in which the examiners work. At present there are about 650 of them, but the number varies almost from day to day. There are from eight to ten resignations a month. Every two and a half years there is a fifty-percent turnover in the employees of this department of the office. The main reason is the small pay. An applicant for a place as examiner must pass a two-day examination. He must understand French or German. He must have training in reading mechanical drawings. He usually is required to have three years' college work, majoring in such subjects as physics, chemistry, and mechanical engineering. He must have completed a course in mathematics through differential calculus. Besides, he has to pass a physical examination. And his initial salary is $2,000 a year. Before he can advance to a position as head of a division, he must have a law degree as well!

MOST of the examiners are students just out of college. They look upon the work as a stepping-stone to a career in engineering or patent law. And, in most cases, just about the time they are trained and begin to be of value, they resign. During the first two and a half or three years, their work must be checked by an older examiner. So, for that period, they not only accomplish about half as much as an experienced man, but they consistently hinder the capable ones by demanding much of their time to go over the work they have done to be sure that nothing has been overlooked.

Even then, sometimes an inexperienced examiner will cause the inventor trouble. Consider the case of the California mechanic who waited patiently for nearly two years to get his patent. Then, after it was issued, he discovered that the examiner, in searching the previous patents, had overlooked one which should have been called to the inventor's attention. His lawyer thus worded his claims to cover more territory than he was entitled to, and his patent was held invalid for this reason. To gain the protection to which he was entitled, the inventor had to have his patent reissued. This meant starting at the beginning again and going through the whole process, thus getting a double dose of the irritating delays.

AREN'T applications ever taken up out of order? Only under three conditions, I discovered. When an application has been in the Office longer than three years, the examiner is privileged to take it up out of its turn in order to clean up the case. If the head of one of the Government departments, such as the Secretary of Agriculture or of the Navy, requests the Commissioner of Patents to give immediate attention to an application which will be of value to the work of that Department, it is usually done. The third condition is when it can be shown that the granting of the patent will result in the employment of a large number of men. Thus, if a corporation can prove that as soon as the patent is issued, it is ready to make a large investment and begin manufacture, special action results.

Probably the best way to understand the difficulties that confront those who are trying to solve the present muddle is to follow an application on its slow progress through the patent maze.

When it arrives in Washington, a clerk in the mail room of the Patent Office stamps and dates the application and sends a receipt slip to the sender. Then the petition is sent on to the application room. Here it is given a serial number and the date of filing is recorded. The application clerk carefully examines the petition to decide what kind of a thing has been invented. It is often two or three days before this is accomplished. Inventions are placed in sixty-two classifications by the Patent Office and the application clerk sends the petition to the head examiner of the division to which it belongs. He looks it over again and decides into which subclass it fits. Each main division is divided into subdivisions called "arts." Thus, for example, "chairs" might be split up into a "swivel chair art," a "Morris chair art," etc. All patents granted are similarly divided into classes. Where it might take a week to look over all patents on chairs, those under a particular subhead can be gone over in possibly half an hour.

WHEN a correct classification of the application has been found, it is turned over to the clerk of its particular division who records the application in a large ledger. Finding the correct pigeonhole for the petition and recording it may take three or four days more. Then it is placed in the files to await its turn. It remains there from one to ten months—the average is seven—before the examiner in charge of the "art" to which it belongs gets around to it. He takes it out again and begins his search to see that the idea is not covered by any previous patent.

He examines not only all the American and foreign patents on similar devices, but he tries to make sure that the idea has not been published in any newspaper or magazine prior to two years before. Each examiner is supposed to become an expert upon his particular "art" or "arts." He goes over technical publications and magazines, such as POPULAR SCIENCE MONTHLY, which print descriptions of new devices and machines. Whenever he runs across a new idea that falls within the range of his work, he clips it out for future reference. No patent is granted upon an idea that has been described in a publication either here or abroad more than two years before the application is made. Copies of the patents already issued, together with such clippings, are kept in drawers that line the walls of the examiner's rooms like the boxes in a shoe store. Each box covers a particular subdivision and each division has from three to five rooms lined with these "shoe boxes."

THE average output of an examiner is about fifteen applications a week. However, in the case of a complicated invention, such as a calculating machine, which sometimes requires sixty sheets of drawings, the examiner may put in a solid month upon it before he can decide whether to grant the patent. Not infrequently the application has to "change horses in the middle of the stream," when one examiner resigns and another takes up the work. This resulted in additional irritations for a professor at Columbia University, New York City, recently. After he had waited for months for some action upon his application, he received a letter from the examiner saying that his invention could not be patented. He filed an objection. After the usual delay, a new man replied, the first one having left the employ of the Government. The new examiner was enthusiastic. He said he thought the professor's invention one of the best ever submitted to the office, but suggested that one of the claims be slightly amended. Two weeks later, the enthusiastic one also resigned. Now the application is waiting to be considered by a third examiner!

When the search is completed, the examiner sends a letter to the inventor or his attorney allowing or rejecting the application. If it is rejected, six months are allowed for the applicant to appeal the decision, and if it is allowed the same length of time may elapse before the final *(Continued on page 133)*

Statement of Ownership, Management, Circulation, etc., required by the Act of Congress of August 24, 1912, of Popular Science Monthly, published monthly at New York, N. Y., for April 1, 1930, State of New York, County of New York, ss. Before me, a notary public in and for the State and county aforesaid, personally appeared Travis Hoke, Editor, who, having been duly sworn according to law, deposes and says that he is the Editor of Popular Science Monthly and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in Section 411, Postal Laws and Regulations, printed on the reverse of this form to wit:

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(Signed) Travis Hoke, Editor.

Sworn to and subscribed before me this 20th day of March, 1930.

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Patent Office Has Become A National Disgrace

(Continued from page 132)

fee has to be paid. In fairness to the Patent Office, it should be pointed out that lack of promptness on the part of inventors in replying to letters and in paying fees often lengthens the time required to get a patent. The "long distance record" in this respect is the noted Fritts case, in which thirty-five years, from 1880 to 1916, elapsed between the filing of the application and the issuance of the patent. The commissioner who considered the case began by saying: "The inventor is dead; the patent attorney is dead; and the only question now to decide is whether the case is still alive." While the inventor, himself, had been responsible for some of the delay, the commissioner declared that much of the fault for the thirty-five-year wait lay with the Patent Office. Such delays must be made impossible.

Even after the final fee of $20, which it is now proposed to raise to $25, has been sent in, there is always an additional month of waiting before the patent is actually granted. The rule is that four weeks after the final fee is paid, the patent is allowed.

IN THE last twelve months, Commissioner Robertson has received approximately 500,000 letters from inventors in all parts of the country. A goodly share of them ask if something cannot be done to remedy the present intolerable conditions. This, POPULAR SCIENCE MONTHLY believes, must be accomplished if one of the country's greatest assets—its inventive spirit—is not to be stifled.

The first step in remedying present conditions is a realization that the problem will not solve itself. In the past, even patent officials believed that the flood of inventions would soon ebb. Today we realize that the attitude of Thomas A. Edison was more nearly right when he told a newspaper reporter: "We don't know one millionth of one percent of anything." The inventive period of the world has just begun. And the future program of the Patent Office must be geared to that realization.

During the last ten years, more patents have been granted in the United States than during the 100 years from President Washington's inaugural in 1789 to President Harrison's inaugural in 1889. In 1929, 114,496 applications for patents, trade-marks, and designs poured into the Washington office. And thus far in 1930, there has been a twelve percent increase over the record-breaking flood of last year. Besides mechanical inventions, the Patent Office passes on about 5,000 designs and 20,000 trade-marks a year. Recently, the requests for trade-marks has increased 100 percent.

APPROXIMATELY one half of the applications are granted. Thus each year there are about 50,000 more patents placed on the twenty-five miles of shelves which hold all those issued in the Washington office. This adds an average of nearly 1,000 apiece to the sixty-two divisions into which all inventions are classified and through which the examiners make their search. As a result, the time required for such a search increases every year.

No other nation has done as much along the lines of invention as America. With one sixteenth of the world's population, it holds one half of all the world's patents. In the United States, an average of one patent for every 150 persons has been taken out. It was the first nation to have an established patent office. Other countries had given protection in the form of monopolies, but the American patent laws set the pace in protecting the poor inventor. An American does not have to forfeit his patent because he is unable to manufacture it, as is the case in other countries. Neither does he *(Continued on page 134)*

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AGENTS

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Patent Office Has Become A National Disgrace

(Continued from page 133)

have to pay taxes upon his invention, as in other nations.

American patent laws have aided the inventor and stimulated invention, and to this fact the nation owes much of its astounding advance along mechanical lines. As the richest nation in the world, and with much of its wealth derived from the products of its inventors, America must take immediate and adequate steps to meet the needs of the present patent situation.

When the new building of the Department of Commerce is completed in about a year and a half, the Patent Office will move into new quarters in one wing. This change will provide sufficient room for present needs, but officials declare it will allow little chance for expansion. What must be demanded of Congress is a forward-looking program that will keep step with inventive progress.

A FORMER Commissioner of Patents has declared that there is no reason why an ordinary application should remain in the Patent Office longer than one week without being taken up for consideration. That goal, welcomed by all inventors, will be achieved only when the present system is altered to allow salaries high enough to retain good men as examiners and appropriations large enough to provide enough men and sufficient facilities for taking care of the volume of business which is increasing yearly. The number of examiners that can be hired and the equipment that can be provided depend upon the size of the appropriation allotted the Patent Office each year by Congress. Thus the Patent Office is dependent upon Congress, and Congress must be made to realize its needs. All those who wish to see progress in this direction should write to this magazine or to their Congressmen, and they should stir up public opinion and agitate for patent relief!

The above program must constantly be urged upon those in authority if the Patent Office is to cease to be a national disgrace and to fulfill again its primary function, as defined recently by President Hoover: "to stimulate and protect American ingenuity and inventiveness."

Why 2,000,000 Americans Are Dope Fiends

(Continued from page 43)

that a dope user lives from a few to thirty years. His weakened condition makes him an easy prey to disease and infection of all kinds. Dr. Hobart A. Hare, famous drug authority, tells of several cases in which the systems of women addicts were so permeated with the drug that their new-born infants collapsed on the second or third day owing to lack of their customary doses.

Few of those who begin using narcotics are fully aware of the aftermath. All narcotics demand larger and larger doses as time goes on. One eighth of a grain is sufficient at the start. But by the end of six months to a year, to obtain the same reaction, the addict requires from two to three grains. The average dose of the average morphine addict is from ten to thirty grains a day. Some dope fiends use as much as 250 grains a day—nearly four teaspoonfuls—an amount sufficient to kill five hundred normal men!

AND the cost of this habit is enormous. An ounce of morphine or a similar narcotic smuggled into the United States is worth $150; seven times its weight in gold. At the European sources, the price is about fifty cents. It costs the average addict *(Continued on page 135)*

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Why 2,000,000 Americans Are Dope Fiends

(Continued from page 134)

from five to seven dollars a day to indulge his habit; the sum, of course, increasing as he uses larger amounts. An addict taking 250 grains daily would spend nearly $75 a day or more than $27,000 a year for drugs alone.

Where, unless the victim happens to be rich, does the money come from? That, Dr. Sirovich told me, is where the relationship between drugs and crime comes in. Narcotics dull the mind and weaken the body of the user so he is unable to earn an honest living and at the same time make him desperate for more money. A large share of the robberies, holdups, and murders committed in America can be traced directly to drugs. These crimes are perpetrated either under the influence of dope, which gives the evildoer the necessary nerve; in order to obtain more narcotics; or under the combination of these conditions. When illegal narcotics go, Dr. Sirovich maintains, a high percentage of crime will go with them.

OF THE 200 tons of such illegal drugs smuggled into the United States last year, 85 per cent came through the port of New York, he told me. Because of the ingenuity of the smugglers, detection is extremely difficult. And so far as the retail peddlers are concerned, they are much harder to discover, arrest, and convict than bootleggers, due to the fact that drugs can be carried about the person or in small bags or brief cases without arousing suspicion.

Still, the Federal narcotic agents often prove a match for the smugglers. In one haul, a short time ago, they confiscated 4,500 pounds in a single shipment at New York City. It came in on a liner in a box labeled "Brushes."

In another case, a box labeled "Bowling Pins" aroused the suspicion of the agents. On the side of the box were the letters "I. T." This meant that the box was "in transit" and was to be taken directly from the boat to a bonded warehouse to await shipment on the first train for its destination. The agents trailed the truck driver who drove off with the box. On his way to the warehouse, he turned into a side street and pulled up before an empty building. Several men came out and together they carried the box inside.

A few minutes later, they emerged again bearing what appeared to be the identical box they had carried inside. The truckman started off. In the next block, the agents stopped him, tore open the box—and found nothing but harmless bowling pins. But when they returned to the building, they surprised members of the dope ring opening the original shipment. In it were bowling pins, but each was hollow and filled with morphine.

A FAVORITE ruse by which big shipments of opium and its derivatives reach America, Dr. Sirovich explained, is as follows: The smuggler poses as an exporter who has an order for drugs from some foreign country. From the State Department, in Washington, he obtains an "export certificate." This allows him to bring the shipment into the United States from a drug factory in some other nation "in transit," to send on to his "customer" in the foreign country. The box cannot be opened while passing through the United States and it is to be kept in a bonded warehouse when it is not en route by railroad or steamer. But somewhere along the way, the shipment is diverted and another box, identical in size, shape, weight, and markings, but filled with any sort of junk, is substituted and sent to the "customer" in the foreign land.

During the past twelve months, narcotics at the rate of more than two tons a month have been shipped to Patagonia, the wild, sparsely-inhabited southern tip of South America. Practically all *(Continued on page 136)*

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Why 2,000,000 Americans Are Dope Fiends

(Continued from page 135)

of these drugs, it is safe to say, "disappeared" somewhere along the route and were used in illegal traffic.

One of the most ingenious systems of smuggling morphine is by means of the "dope letter," a method recently uncovered in an American penitentiary. Someone on the outside sends an inmate a harmless-looking letter. It appears to be on ordinary writing paper. But, before the letter is penned, the paper is soaked all day in water saturated with morphine. Then it is allowed to dry, after which a short note is written on it. In prison, the convict tears off and dissolves in water pieces of the missive each day, thus obtaining an uninterrupted supply of the drug.

At another institution, a suit of clothes was sent to an inmate. It was found that each button on the garment contained a cavity filled with opium and morphine. Another time, a woman sent a picture of her son to a friend in prison. When guards examined the photograph, they found that enough morphine was hidden in the back to last for three months.

RECENTLY, Federal agents captured a supply of narcotics being carried about in a Bible. The center of the book had been hollowed out to provide space for morphine, cocaine, and hypodermic needles. Another time, they found a supply of dope hidden in cakes of soap. The cakes looked exactly like dozens of others in the same carton.

Candy is often used by dope smugglers to hide their contraband wares. The heroin, cocaine, morphine, and opium is coated with chocolate to give it the appearance of an ordinary piece of candy. In some cases, the dope is colored with dyes so it exactly matches the hue of the caramel or chocolate in which it is secreted. Cigarettes, with dope hidden inside, is another method by which the dope peddler escapes detection.

When the headquarters of a notorious drug ring in the eastern part of the United States was raided some time ago, quantities of morphine were found concealed in the panels of the wall with hidden scales for weighing the dope. By employing such devious methods, the narcotic smuggler escapes detection. There is only one Federal narcotic agent for every half million people in the United States. Consequently, most of the large hauls made by Federal men are achieved through information from disgruntled employees of the smugglers, or through lucky accidents.

Such an accident took place a few years ago in New York City. An automobile bumped into a barrel of "fish" which had just been unloaded upon a pier from a vessel. The barrel tipped over and, from a tin container within, there tumbled a flood of white pellets that looked like moth balls—a fortune in pure morphine. The entire consignment was found upon examination to contain illicit narcotics valued at three quarters of a million dollars.

Four drugs—opium, morphine, heroin, and cocaine—are the ones that are smuggled and cause all the trouble. Cocaine, extracted from the coca leaf of South America and Java, is used so infrequently that the main fight centers upon the other three, all derived from the opium poppy of China, India, Persia, Turkey, and Egypt. It is estimated that there are as many as 100,000 users of opium, morphine, and heroin in the city of New York alone!

AT FIRST sight, crude opium suggests the pulp of crushed raisins. It is obtained by cutting the side of the unripe seed capsule, which is about the size of an egg, when the poppy is a little less than a year old. From the cut a milky white secretion oozes. In twenty-four hours it turns dark and coagulates. From this crude (Continued on page 137)

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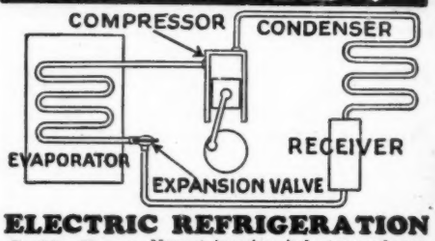

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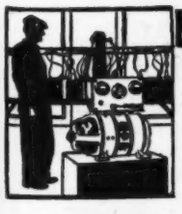
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Why 2,000,000 Americans Are Dope Fiends

(Continued from page 136)

opium morphine is extracted, and from morphine heroin is obtained.

In all, eighteen narcotic drugs are derived from crude opium. Morphine usually comes in tablets that look like aspirin. Heroin and cocaine, known to addicts as "snow," are white powders having the appearance of talcum. Both cocaine and heroin are sniffed up the nose in the manner in which snuff is taken. Morphine is usually injected with a hypodermic needle and opium is eaten or smoked.

Just what happens when such drugs are taken? The first effect is a feeling of exhilaration, Dr. Sirovich explained. The drug affects the medulla, or "small brain," stimulating heart and lung action. The addict feels strong, happy, courageous. Hence the name, often applied to heroin, "happy dust." This lasts from half an hour to an hour. It is during this period that heroin-using gunmen commit their murders and holdups. Later, the drug deadens the cells of the main brain, particularly those in the forepart which govern perception, and the addict falls into a stupor filled with pleasant dreams. This lasts from eight to ten hours. The awakening is accompanied by nausea, headache, tremors, and depression.

FANTASTIC hallucinations are often experienced by the confirmed drug user, while another curious effect produced by narcotics concerns the eyes. When a doctor examines a patient who is in a drug stupor, the first thing he does is lift the eyelids and glance at the pupils. If they are contracted into pin points he knows morphine or opium was the drug used. If the pupils are dilated, heroin was used. However, young ambulance surgeons are always warned to look at both eyes when they are called to examine a man found unconscious. If one pupil is small and the other large, the victim has been black-jacked or has fallen and struck his head, resulting in a hemorrhage of the brain on the side of the pin point pupil.

A question that many people ask, and one that I put to Dr. Sirovich, is: How can you tell a drug addict? In the early stages it is often impossible, he told me. But later many signs are evident. The features are expressionless, indicating a lack of mental activity. The cheeks are sunken and the eyes lusterless. The color of the skin varies from a waxen pallor to a bluish appearance. The finger nails become brittle and chip off. The teeth soften and crumble away. Gradual loss of weight increases monthly. Addicts become excessive cigarette smokers. The blood pressure of morphine users is above normal; of heroin users, below normal. Yawning every few seconds is a symptom. Tremors are frequent and extreme muscular weakness finally ends in collapse.

Frequently addicts become fanatics, crusaders for drugs, seeking to persuade others to take up the habit. They think of nothing else, and when two or more addicts get together they talk for hours about their experiences.

In that way, many a weak character is made into a dope fiend. And like all other vices, the habit is much easier to acquire than to lose. Curing an addict is a difficult procedure and seldom entirely successful. At institutions where drug users are given the "cure," the amount of drug is reduced gradually. This tapering off process requires from a month to six weeks. Only in cases where the patient strongly desires to be cured is the effect permanent. Most addicts return to the drug as soon as they are released.

Thus medical science is almost powerless to redeem these unfortunates. The only way to combat this grievous evil is eternal vigilance on the part of the Government and, better still, the cessation of manufacture of all narcotics not required for medical or other scientific purposes.

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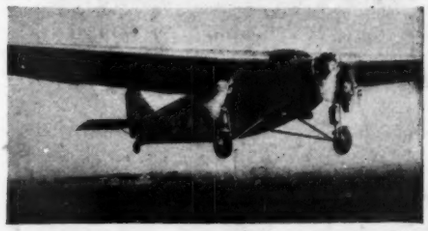

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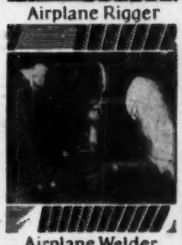
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A New Light on Canned Foods

(*Continued from page 44*)

a view to pleasing a wide variety of tastes.

The first day, Miss Parrish treated her "family of five" to this repast served, of course, in duplicate:

Menu No. 1
Grapefruit Cocktail
Baked Ham
Candied Sweet Potatoes Buttered Spinach
Stewed Tomatoes
Fig Pudding

How did the two meals compare? The fresh-foods dinner cost $3.16 and that made from canned goods $3.92, an advantage of seventy-six cents in favor of the fresh meal. However, the committee were served larger portions of ham, candied sweet potatoes, and tomatoes when they sat down to the canned dinner. This was due to unavoidable waste in the preparation of the fresh meat and vegetables.

THE total time consumed in preparing the canned articles was thirty-five minutes; that in cooking them, one hour and forty-four minutes. The fresh-foods dinner took two hours and eleven minutes to prepare and eight hours and fifty minutes to cook. Miss Parrish and her assistants boiled the ham for three hours the day before and baked it forty minutes before serving. The fig pudding, too, had to be steamed three hours on the previous day, and steamed for another half hour just before dinner. Naturally, however, several items on the menu were prepared or cooked at the same time and thus there was much overlapping of time. A housewife, Miss Parrish calculated, can prepare this particular dinner in five hours and fifty-six minutes from fresh meats and vegetables; if she makes it from cans, it will only take her seventy minutes actual time. After tasting both "versions" of the meal, the committee decided that the fresh dinner was superior in flavor in every instance except the tomatoes.

On the second day, the committee was called upon to judge the following double dinner:

Menu No. 2
Roast Chicken
Sweet Potato Puffs String Beans
Cranberry Jelly
Pineapple

IN THIS case, the canned meal was sixty-four cents cheaper than the fresh. The outlay for the canned food was $1.77; for the fresh chicken and other articles, $2.41. But there was considerable difference in the size of the portions. When the more expensive fresh dinner was served, the "family of five" sat down to three pounds three ounces of roast chicken, while the quantity of canned chicken, after removal of the jelly and cooking, had shrunk to only one pound six and one quarter ounces. Four pounds of fresh chicken had been bought, and three pounds of canned. The test showed that the edible portion of fresh chicken is more than twice that of canned, and that a family of five really would require two three-pound cans of chicken. That would bring the actual cost of this dinner, in canned form, to $4.84 instead of $1.77.

No previous day preparation or lengthy baking and steaming processes were involved in this fresh meal, and so the time saved in preparing its duplicate from cans proved less than in the case of Menu No. 1. Miss Parrish and her students devoted one hour and forty-four minutes actual time to the fresh dinner and forty-four minutes to the canned.

And what was the verdict of the judges? The canned chicken, they ruled, was overcooked and in shreds, and did not taste as well as the fresh. They liked the flavor and color of the fresh sweet potatoes better than those of the canned, and the string beans, too, they found superior. The cranberry jellies they pronounced quite similar in flavor and consistency, but they thought the fresh product was prettier in color. Both the fresh and canned pineapple were to their liking.

On the third day, the "contest" was between fresh and canned versions of this dinner:

Menu No. 3
Cream of Celery Soup
Salmon Cutlets
Spaghetti with Tomato Sauce Vegetable Salad
Apple Sauce

This meal proved considerably cheaper in canned form than in fresh. The total outlay for the canned goods was only $1.81; for the fresh fish, fruit, and vegetables, $3.85, a difference of $2.04. It took Miss Parrish just fifty-three minutes to prepare and cook the canned dinner; the fresh meal consumed two hours and forty-seven minutes. The "family" was greatly pleased with the canned-goods meal and found it about equal, in quality and flavor, to the fresh. The canned soup, salmon, and apple sauce, they said, were as good or almost as good as the fresh varieties. But they liked spaghetti with fresh tomato sauce best and preferred fresh vegetable salad, both for flavor and appearance, to the canned.

The fact that the tests were made in winter, when fresh vegetables and fruits generally are believed to be more expensive than in summer and fall, at least in the eastern part of the United States, did not affect the cost of the fresh-food meals. According to the New York City office of the New York State Department of Agriculture and Markets, vegetables and fruits were plentiful last winter and could be bought approximately at "summer" prices.

And what were Miss Parrish's conclusions?

"Canned goods," she said, "are cheaper than fresh foods, provided the items are chosen with care and discrimination. Obviously, they can be cooked and prepared much more quickly and easily. As for flavor, that, of course, is a matter of individual taste. My 'family,' on the whole, seemed to prefer the taste of the fresh meats, fruits, and vegetables."

So far as nutritive value and healthfulness are concerned, canned goods are equal, and perhaps even superior, to fresh, in the opinion of Dr. Walter H. Eddy, professor of physiology in Teachers College, Columbia University. The canning process, he has found, preserves rather than destroys the nutritive qualities of food, and the belief that canned foods are less healthful is based on an erroneous vitamin theory (P. S. M., Aug. '26, p. 40). Experiments have shown him, for instance, that there is five times as much vitamin C (the preventive of scurvy) in canned cabbage as in boiled fresh cabbage.

Pins in Cork to Mark Bottles of Poison

BOTTLES of poison may be made less dangerous for householders by having pins stuck into their corks as a warning device, suggests the National Safety Council, in Chicago. Although many druggists now sell poisonous substances in bottles distinguishable either by peculiar shape or sharp points, nevertheless the average home has various deadly chemical compounds such as rat poisons and disinfectants which are kept unmarked in the pantry or bathroom.

If the corks of all poison bottles were studded with good-sized pins, they probably would make the user examine the bottle before sampling the contents.

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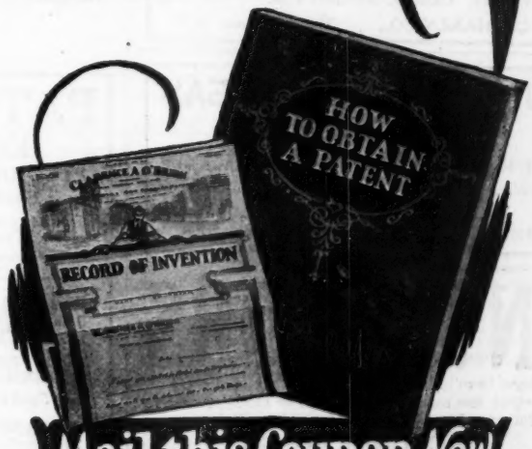

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Tricks That Add to a Car's Speed

(Continued from page 74)

"in the first place here's your money. You're a good sport, kid; you didn't try to pull any alibis. That Hank would beat you was a sure thing and I wouldn't bet on a sure thing. You were licked before you started. The two cars are the same make and model and you're a good driver, but that had nothing to do with it. What did mean something is that Hank has been playing with auto motors long enough to know some of the tricks of getting the most out of them. For instance, what did you do to your carburetor before the race?"

"Nothing," Jack replied. "Why should I? It was all right."

"Not for racing or hill-climbing tests," Gus explained. "Hank set his for a good rich mixture that would give him plenty of kick on the hill and the last mile of speed on the level. What did you do to the ignition?"

"I checked that, all right," said Jack. "Looked over the spark plugs to make sure that there weren't any fouled ones and I looked at the breaker points to make sure they weren't getting pitted."

"ALL right for ordinary use," admitted Gus, "but Hank came here last night and got himself a whole new set of spark plugs and also a new set of spark plug cables. You two have had those cars nearly a year, and while the spark plugs and ignition cable are plenty good enough for any ordinary service, if you want to get the last ounce of pep out of the motor, new plugs and new cable will help a trifle—and it only takes a couple of trifles to make a difference between two cars of the same make."

"Gosh," young Landrith exclaimed. "Anything else?"

"Sure," Gus smiled. "Hank spent nearly an hour here last night just making sure his brakes didn't drag the tiniest bit. You know how fussy he is about draining the crank case every little while and grinding the valves every few thousand miles. He even went over the wheel bearings and made sure they were set just loose enough."

"I'll bet he put one over on me by taking his muffler off, too," Jack suggested.

"I know he didn't do that," Gus asserted, "but he did get busy with the generator and moved the third brush over as far as he could to get the charging rate way down so that the generator didn't drag on the motor so much.

"There's another point where you missed out," Gus continued. "I never could get you to believe that it paid to use real good gas. Hank knows better. He buys the best he can get. And the same goes for oil, too. Another thing: You jam your transmission case and rear end full of cheap grease. It doesn't lubricate as well and makes a lot more friction than good transmission oil."

"Well, anyhow, I had sense enough to pump up my tires," Jack maintained.

"Yes, and how did you do it?" inquired Gus. "You probably put just as much air in as the makers recommend. That's right for regular use, but if you want to cut down the rolling friction on good roads, shoot in an extra five pounds or so."

"Good night!" said young Landrith disgustedly. "The next time I'll try to know a little more before I start shooting off my face!"

"That's a real good idea, too," Gus agreed.

DID you ever wonder whether your dreams last for an hour, or only a split second? What makes you dream you are falling? Can dreams be made to order? A noted psychologist tells, in a coming issue of POPULAR SCIENCE MONTHLY, how for the first time—through an unexpected discovery—he has solved these and other fascinating mysteries of dreams.

Glass Walls Now Used in Building

(Continued from page 39)

dead-air space is said to make them heat-insulating and soundproof. Tests at technical schools of Dresden, Berlin, and Munich, in Germany, have shown that these glass bricks may be made thoroughly fireproof.

In Germany the glass bricks have had wide application. A large airplane hangar at Munich, just completed, is walled with the bricks, laid on a concrete framework. It is said to be as light inside as outdoors. Elsewhere the bricks have been used in such varied places as the roofs of underground railway stations and the walls of small filling stations.

NO ONE knows who started the "glass house" idea. One of the first, even before the German pioneers, was Frederick Keppler, a young London architect. Twenty-five years ago he stared at the fog from his window and conceived the idea that the entire wall might be made into a window. After experimenting, he developed square, six-inch tiles of heavy glass, fitted together in twos so that each pane was of double thickness. Ribs left an air space between. The tiles bore a design in relief, so that they could not be seen through. These were the blocks of which the glass walls in the building at Magdeburg, Germany, a Government convention hall, were built.

Now a resident of this country, Keppler plans an American plant where his glass building tiles will be produced in quantity. The plant will be in operation, soon he says.

Meanwhile plans are going forward for the greatest of all glass structures—the eighteen-story apartment houses which the architect Frank Lloyd Wright proposes. Radical as the structures are, they are said to have been approved and the actual building of those in New York is understood to wait only upon negotiations for the purchase of the necessary land.

These novel buildings are upside-down versions of the usual style of construction. They will be slightly larger at the top than at the base, tending to give them the topheavy appearance of an inverted pyramid. The base will be a massive pedestal of concrete. From this will rise four piers of concrete, through the center, to the top. Floors, like shelves, will extend outward from these central piers.

Walls for these buildings will be great shells of copper and glass. "The glass will be thick or thin," Wright says, "as the needs of the room require." It will be of a type which it is claimed admits the ultra-violet or health rays of the sun. Since water running down the walls in heavy rains would obscure the light, each floor projects beyond the one below it.

FOR ventilation, whole panes of the glass open on hinges like casement windows. Heavy drapes can be swung together upon the glass walls to assure privacy and to regulate the brightness of the light.

Although Wright is noted for his radical ideas in architecture, he is far from being a dreamer. He built the Imperial Hotel at Tokyo, said to have been the only building of importance that withstood the famous earthquake of a few years ago. He is also called the original designer of the American bungalow style of home. Such a reputation insures that the glass houses he projects, though novel, are architecturally sound.

Nor is he the only prominent advocate of glass in building. Harvey Wiley Corbett, New York architect, plans a glass-walled industrial center of modernistic design, including a twenty-five-story building, as a $6,000,000 project in the neighborhood of New York City. Two other prominent architects, Hugh Ferriss and Joseph Urban, told POPULAR SCIENCE MONTHLY that they are interested in the new building materials of glass, although they await further data as to their strength and other qualities.

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Dogs Are Smart—How About Cats?

(*Continued from page 57*)

it repeated on three different winter mornings.

In another case a cat had some oil spilled on its back while a lamp was being trimmed. Later, while sitting near the grate, its fur caught fire from a spark. Immediately it dashed out of the house and made for the village watering trough, into which it plunged and extinguished the flames. Astounded at first, members of the household afterward realized that the fire in the grate was put out with water nightly in the cat's presence. These examples, if accepted as authentic, suggest the ability not only to learn from observation, but to make plans accordingly, both of which are indications of high intelligence.

ROMANES reports several instances of cats that opened doors by pushing thumb latches and turning door knobs, ringing bells and lifting knockers. In some cases, when the doorbell itself could not be reached, the cats jumped at the bellwires and rang the bell in that manner.

A number of cats are known to catch fish. Considering their dislike of water and the obvious difficulties, keen observation at least must be conceded—unless the action is in response to an age-old instinct.

As for stories of intelligent dogs, these, of course, are legion. Charles Darwin, the father of evolution, had a dog who remembered him well after five years. "He obeyed me," wrote Darwin, "as if I had parted with him only an hour before."

Romanes tells of a skye terrier that hated to be washed. As time went on, its aversion to bathing became stronger and stronger. At last the dog became so fierce at the very sight of water that the servants of the house refused point-blank to give it a bath. Then the terrier's mistress tried it herself. But even she was not safe. Cajolery, threats, beating, and starvation were of no avail. Finally, the owner decided to give the dog the "silent treatment." She paid no attention to it. She was in the habit of taking it along on her daily walk, but now went out without it. When she sat reading or sewing and it came up to her, she turned her head and looked away. This lasted ten days. At length the dog came up to her one morning with an expression that plainly said: "I submit." Immediately it was given a bath, which was endured patiently. Then, barking joyously, it bounded for the door to go for the customary daily walk. When next a bath was due, the terrier at first was obstinate. But all its mistress had to do was to turn her head and the dog would run for the tub!

A DOG and his master were crossing the frozen river Dee, in Scotland, when the ice broke. The man had a gun and was able to keep himself from sinking by placing it across the opening. When the dog's own efforts to save its master proved fruitless, it ran to a neighboring village, grasped a man by the coat, and by gestures prevailed upon him to follow. The stranger arrived in time to save the master's life.

Similar examples are familiar to everyone. They indicate an ability to reason that is almost incredible for lower animals.

An English terrier was taught to ring for the servant. To test whether the dog knew why it rang, it was told to do so while the servant was in the room. Repeatedly it refused to obey. The moment the maid was gone, however, it rang as soon as ordered.

Some of the most remarkable stories have to do with the recognition of photographs. One dog, for instance, when its master was away from home, spent much of its time in the parlor gazing at its master's portrait and softly whining. No similar behavior in a cat has ever been reported.

Many dogs seem capable of acting a part, meaning that they indulge in make-believe in real life; not in the movies, for which they are trained. A terrier was fond of catching flies on the window pane, but showed much annoyance when its failures were laughed at. Eventually it became so distressed that it pretended to catch a fly, going through all the appropriate motions. When its master pointed out that the fly was still on the window, it slunk away in shame.

Many instances are known of dogs snatching food in the kitchen and hiding it and then pretending to be asleep when they heard the cook returning. Dogs that slip their collars off to go on poaching parties and then get back into the collar again on their return also belong among these untaught actors.

Perhaps the clearest cases of reasoning are those in which the dog estimates the strength and direction of a current. One dog had to swim a swift channel about a mile wide. If the tide was flowing, it would run about a mile to the north before plunging in; if ebbing, it would run to the south, in either case arriving almost exactly at its destination.

ANOTHER dog that lived on a ship was seen gazing intently at floating straws and sticks to estimate the drift of the tide when swimming to the ship from the wharf. When no sticks were visible, it would drop one paw in the water, feel the way the tide ran, and run up or down stream as the case might be. There are even apparently well authenticated examples of dogs taking trips on railroad trains and not only getting off at the right station, but taking a return train home.

Evidence from experiment and anecdotes, then, strongly favor the dog as the more intelligent of the two animals. But to make a fair comparison, the striking contrast presented by the dog and the cat should be taken into account. And to understand that, the wild stock from which they were evolved should be considered.

The dog and the cat are almost exact opposites. The dog is descended from a gregarious species, the wolf, and the cat from a solitary species, probably the wild cat. These ancestral characteristics are still plainly visible. Domestication has bred out the fierceness, but the countless centuries of evolution have left a mark too deep to erase.

In the dog, therefore, the long history of its ancestors as members of the first social group, the primitive pack, is reflected. United alike in offence and defence, each responsive to its fellows in the group, the social instincts were developed and the foundation laid for companionship and coöperation with others. The aloof and solitary ancestors of the cat, on the other hand, passed on the traits of self-sufficiency, cunning, and strategy.

THE old habits persist. The dog pursuing its quarry still barks his noisy encouragement as if the rest of the pack were present. The cat moves toward its prey in stealthy silence. At the approach of danger, the dog growls a note of warning. Once a useful trait, it has now been partly outmoded, except in watchdogs, for there is no pack either to warn or to come to its assistance. The cat, perceiving danger, makes no sound.

The dog also eats as if in competition with others, gulping its food hastily and swallowing even large pieces without stopping to chew. But the cat is a dainty eater, likes to take its time, and frequently plays with its victim before killing and eating it.

Unprepared for solitude by instinct and history alike, the dog is utterly miserable when left by itself. Having adopted a human master as the substitute (*Continued on page 143*)

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Dogs Are Smart—How About Cats?

(Continued from page 142)

for the pack, it follows him faithfully and grieves in his absence. A cat that would follow its master would be a rare exception, though it sticks to familiar territory and hates a change of scene.

This also explains the obedience of the dog and its sense of responsibility. Being a gregarious animal, it seems to accept an outside standard of right and wrong conduct and to understand what is expected of it. When it breaks a rule, instead of being indifferent, it reveals its guilt unmistakably and will bear punishment. Even if the punishment is severe, it is so dependent upon its master's company that it is usually willing and even anxious to be friendly again. The cat seems to have no ability to accept responsibility, and if punishment is attempted will either fight or flee.

THE emotional expression of the two animals also is almost exactly reversed, so that the same act may have quite a different meaning depending on which animal is studied. For example, a dog wags its tail as a sign of friendliness, but a cat wags or lashes its tail only when it is angry. Erection of the tail means excitement for the dog, as in pointing game or meeting a challenge, but the cat's tail goes up when it seems most amiable, as when rubbing against its master's leg.

Caress a dog and it sinks down with tail lowered, but stroke a cat and it stands upright. In fear, the dog goes flat to the ground, while the cat arches its back to such an angle that the fore and hind feet almost touch. In hunting, the dog prefers daylight, roams freely, and covers a wide territory; the cat as a rule lies silently in wait to pounce on its prey as it passes.

One physical characteristic the dog and cat seem to have in common—there is strong evidence that both are color blind. Though they can very often distinguish between colored objects, this is due not to the difference in color but to difference in brightness. The dog also is handicapped in vision by farsightedness. Since the retina of both animals lacks a fovea, or area of clear vision, it is probable that they see only vague shapes without the sharp outlines of human vision. If there is any advantage as to vision, it seems to lie with the cat. In hearing, however, and also in the ability to distinguish between faint odors, the dog is markedly superior.

THE dog has a larger brain than the cat, but it is the larger animal. In terms of capacity for training, such as minding sheep, carrying packages, standing guard, doing tricks, and so on, the dog again has a marked advantage. But is this due to greater intelligence or merely to a greater willingness to coöperate? The cat may not be interested in jumping through a hoop to please the teacher. On the other hand, it simply may not be smart enough. The present experiments at Columbia may furnish a definite answer.

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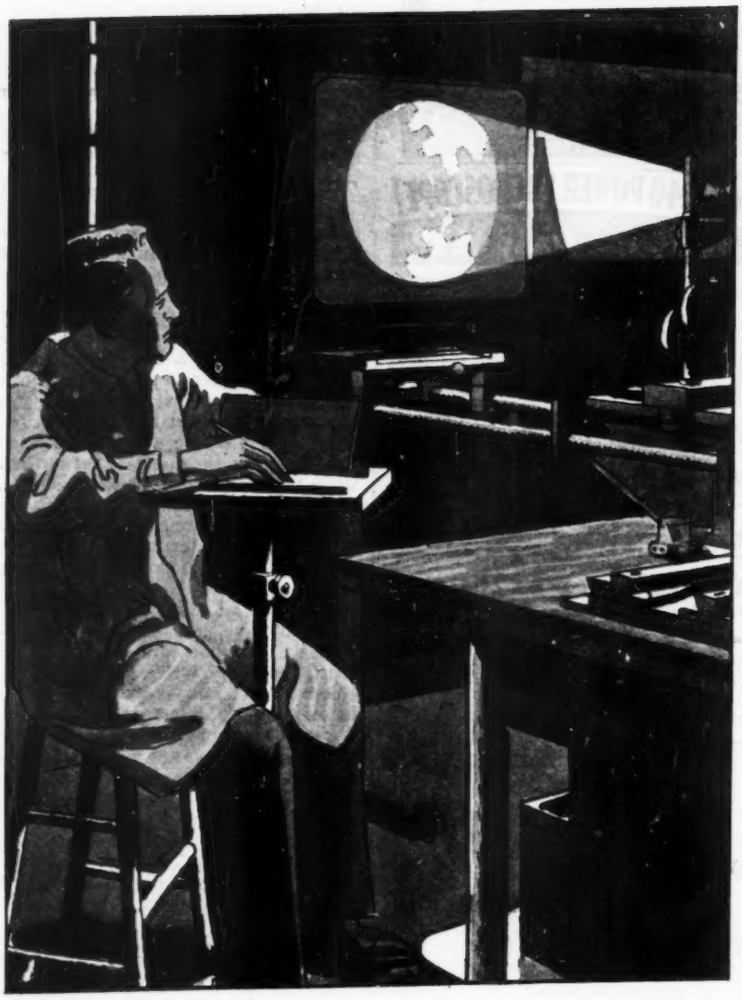

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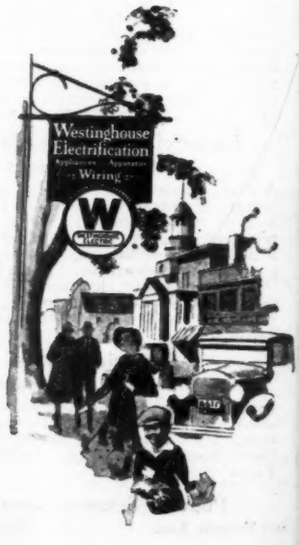

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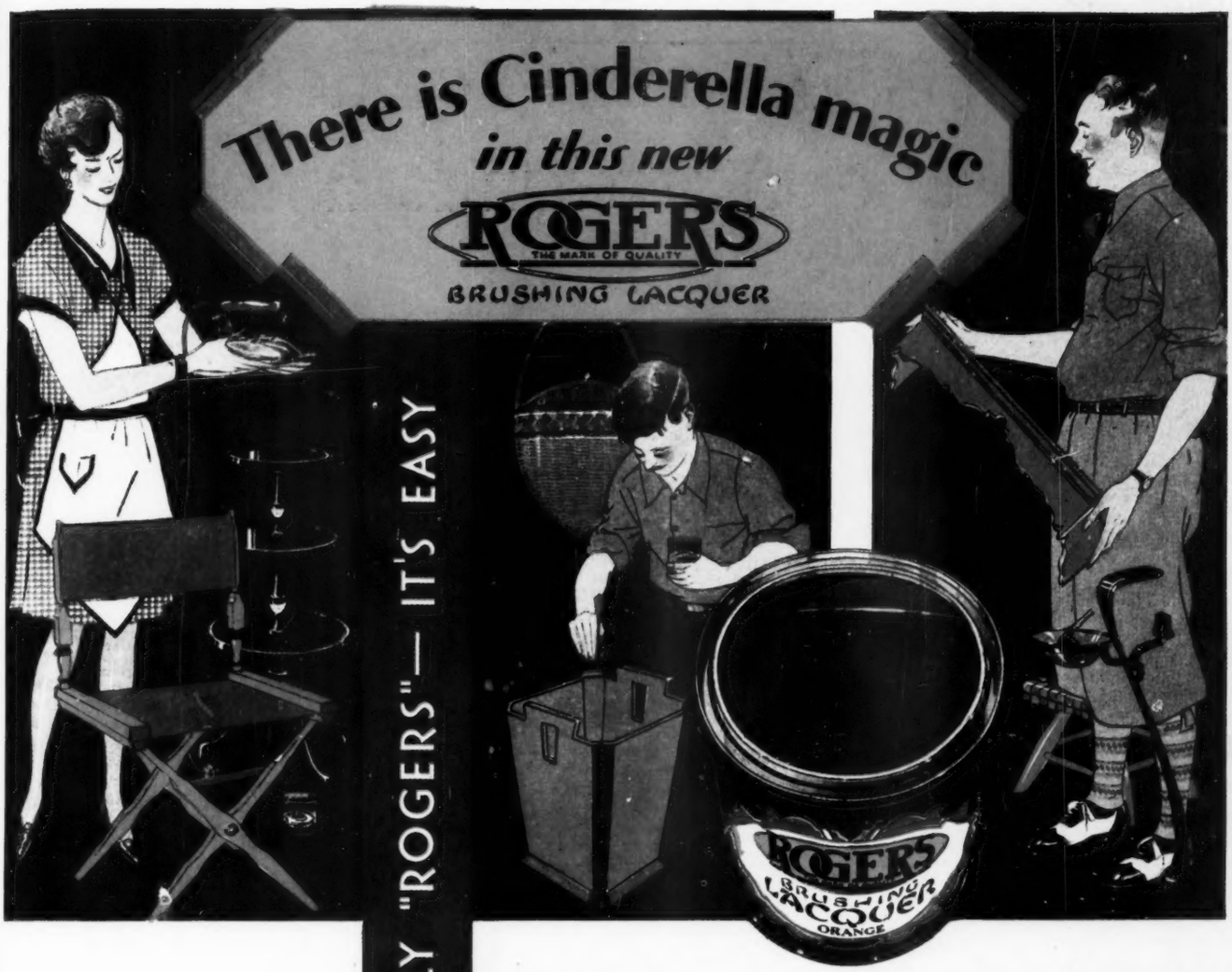

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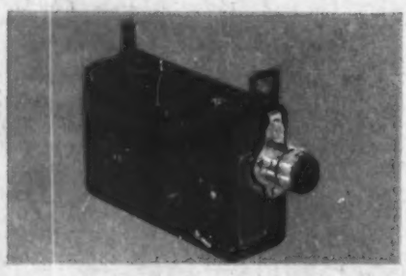

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